JUNE

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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Fractures of Bones of Face—*Aufderheide*
Trigeminal Neuralgia—*Davis*
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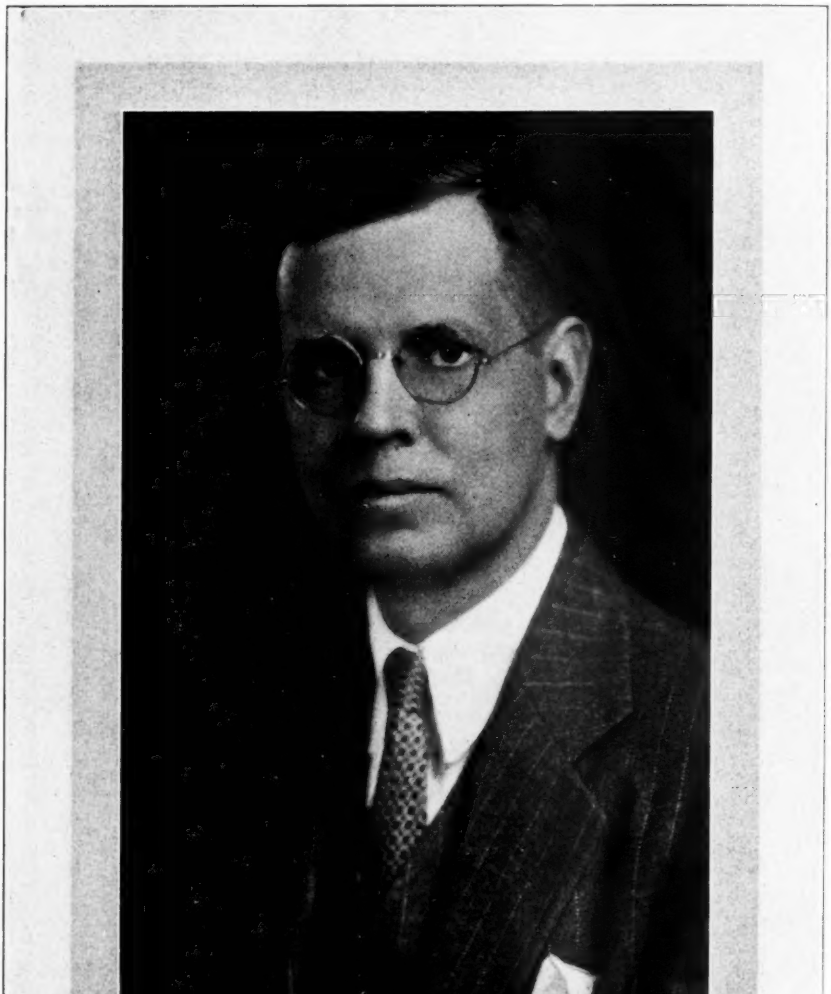

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THE JOURNAL
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Original Communications

AGRANULOCYTOSIS*

By JOSEPH E. SCHAEFER, M.D., Chicago, Ill.

AGRANULOCYTOSIS is a term which signifies the absence from the blood of the white blood cells called granulocytes. The disease is also frequently called agranulocytic angina, for the reason that, in the majority of cases, it is associated with lesions of the throat and mouth. The state of the blood can be demonstrated only by microscopic examination. The lesions of the throat and mouth, on the other hand, produce pain, which leads to inspection, when they are immediately evident to the unaided eye. Hence, the throat and mouth lesions have a high diagnostic importance, and it is on their account that this disease takes on significance for the stomatologist and for the dentist. "The beginning of the war," it has been wisely said, "is in the hands of him who first sights the enemy. Success or failure rests with him." Particularly when the lesions are on the gums and prostration appears relatively late, it may very well be the dentist who first sights the enemy in a case of agranulocytosis. A further reason that this disease, which represents a grave, acute medical emergency with a mortality of about 90 per cent, must interest dentists is that, in a large number of reported cases, it has followed tooth extraction.

It was only about ten years ago that the disease was recognized and given a name. In 1922, Schultz, in Germany, published a description of a series of typical cases. Since then, cases have been reported from various parts of the world, but particularly from Germany and America. Hundreds are now on record, and it is thought by some that the incidence is definitely increasing. The condition can develop at any age from early infancy to senility, but shows a predilection for middle-aged women.

A certain amount of criticism has been leveled at the designations "agranulocytosis" and "agranulocytic" as more logi-

*Read at the Fifteenth Annual Meeting of the American Society of Oral Surgeons and Exodontists, Chicago, Ill., Aug. 4, 1933.

cally suggesting increase in the atypical agranulocytic cell, a leukocyte without granules, than the absence of granular leukocytes, which is what it is intended to convey; and various alternative names have been proposed. Among these, the most successful in gaining a foothold has been neutropenia, and the disease is now frequently described under the name malignant neutropenia.

In addition to the problem of terminology, there is the more important question as to whether agranulocytosis can be called a disease entity or must be termed a syndrome; that is, whether it should be studied as a disease with an etiology of its own and a clinical course and pathology of its own, or whether it is best considered as a more or less closely connected body of symptoms, which circumstances may cause to appear together with particular frequency, but which are not essentially dependent on the same cause. This is a question which time will decide. Until recently, pernicious anemia, with its manifestations in the blood and in the spinal cord, was thought to be a syndrome. The latest investigations, especially therapeutic investigations, with liver therapy, have shown it to be a disease entity.

A more interesting question, still undecided, is whether agranulocytosis is primarily a disease of the bone marrow or an infection of the mucous membranes. Do the mucous membranes become infected because they have been deserted by their usual protectors, the neutrophilic polymorphonuclears, and are hence left helpless before the attacks of all the various micro-organisms that have easy access to them? Or does the bone marrow cease to produce these cells, which normally prey on invading bacteria, for the reason that it is itself attacked by an infection originating in the mucous membranes?

The course of the disease is ordinarily so rapid that the query as to which is the original lesion is not so easily answered as might be supposed. The onset is typically sudden. In some cases, the patient reports a prodromal stage of lassitude for a few days; in others, the clinical triad —high fever, prostration and lesions on the mucous membranes—develop without warning. The fever remains continuously high, with irregularities, but no real drop. The prostration is profound. The mucous membrane lesions are characteristic. Their preferred site is the tonsils, but they may appear anywhere on the pharynx and buccal wall, on the gums and on the tongue. In some cases, they may also be found on the mucous membranes of the anovular region, and, at necropsy, they have been discovered throughout the digestive tract from the esophagus to the rectum. Their typical site is the throat and mouth. There is first a reddening and local swelling, then a whitish exudation, sometimes pseudomembranous, followed by ulceration and a deep spreading necrosis. Pain is intense and swallowing difficult. The breath is fetid. In the typical picture, hemorrhage is absent, but so many cases with hemorrhage have been reported that a variety with hemorrhagic tendency is now recognized.

It is the necrotic lesions that are particularly typical of the disease. The rapidity with which infection runs on to necrosis is startling evidence of the complete lack of defense of the tissues. There is no suppuration. Swelling of the regional lymph glands is absent or slight. All barriers are down. The course of the local infection can be compared only to the march of an invading army through territory where only old people and children remain. No fight is put up. Subjection is prompt and complete.

When a specimen of the blood is examined, the picture revealed by the micro-

scope is even more surprising and is fully adequate to explain the unopposed course of the lesions of the mucous membranes. The total number of white cells is greatly reduced and, more significant, the granulocytes are found to have disappeared, almost or quite completely.

To understand the full importance of such a finding, a brief review of the white cells of the blood is in order. These consist of granulocytes, monocytes, or transitional cells, and lymphocytes. The granulocytes are so called because their cytoplasm contains granules. The granulocytes are again divided into three varieties, the neutrophils, the eosinophils and the basophils. The last two varieties make up so small a percentage of the whole that, practically, when one thinks of the granulocyte, one has in mind chiefly the neutrophil granulocyte, which is the polymorphonuclear leukocyte. These make up normally about 75 per cent of the total white blood cell count in adults, and considerably less in children. They appear in the circulating blood as mature forms and young forms, and their classification forms the basis of some of the most interesting and promising work done in clinical hematology in recent years. They are predominantly phagocytic and form the "soldiers of the line" in our protection in the fight against disease-producing bacteria.

It is these highly important cells, normally present in such abundance and normally increasing when infection is present, that disappear from the circulating blood in agranulocytosis. There is sufficient evidence that they are not destroyed in the blood and that there has been no "flight into hiding" to force the patient off the granulocyte standard. The cause of their disappearance is that they have ceased to be produced by the bone marrow. Since one of these cells remains in the circulating blood for about four days, the bone marrow must be assumed to have stopped manufacturing them four days before the differential count shows their complete absence.

The lymphocytes are less rapidly affected than the granulocytes, yet the absolute number is greatly reduced, even down to a few hundred per cubic millimeter of blood, while their relative number is increased. A point may even be reached at which the lymphocytes are the only white blood cells left, comprising not 20 per cent, which would be about normal, but 100 per cent of the total leukocytes. Thus, in a case published last month,[1] the white cells numbered 900 and there were no granulocytes. Similarly, in a case reported by Harkins,[2] the white cell count was 900 on each of two successive counts on the twenty-first and twenty-fourth days of the month, and on each occasion there were 100 per cent leukocytes. The rapidity of the disappearance of the granulocytes from the blood is another striking phenomenon. The disappearance is progressive, but no more than four or five days is required for the count to decrease from 4,000 to 0.[3] Remembering that this is the length of time required for the granulocytes already in the blood stream to be eliminated, we gain an idea of how rapid and complete may be the action of whatever cause it is that suspends the manufacture of these cells in the bone marrow. Meantime, the manufacture of red cells and of platelets goes on as usual.

To return to the question as to which is primary, the mucous membrane infec-

1. Foran, F. L.; Sheaff, H. M., and Trimmer, R. W.: Agranulocytic Angina: Treatment by Use of Parenteral and Oral Liver Extract, J.A.M.A., 100:1917 (June 17) 1933.

2. Harkins, H. N.: Granulocytopenia and Agranulocytic Angina with Recovery, Arch. Int. Med., 47:408 (March) 1931.

3. Chalier, J.; Martin, J. F., and Naussac, H.: Sur l'agranulocytose, Sang., 6:962, 1932.

tion or the bone marrow disease, cases may be cited from the literature in favor of both hypotheses. There are cases in which the lesions of the mucous membrane were present before the beginnings of a change from normal appeared in the blood picture. There are other cases in which the characteristic change in the blood picture definitely preceded any other symptoms. This has been demonstrated again and again in cases wherein blood counts were made for other reasons, and notably in recurrent cases. Roberts and Kracke[4] relate a case in an elderly woman who was in her usual good health March 10, but returned from an automobile ride feeling much fatigued. The next day, she seemed unlike herself and slept most of the time. By evening, one tonsil was inflamed and there was fever. The next day she was stuporous and a blood count showed 2,050 white cells without a single polymorphonuclear. The entire number were lymphocytes. The blood count of the following day, March 13, showed signs of beginning regeneration in that a few young forms of the polymorphonuclear cell were seen, although the clinical picture continued to grow worse, with necrosis of the tonsil and delirium. Three days later, mature polymorphonuclears began to be seen on the blood slides and clinical improvement was evident. It seems that even a few granulocytes in the blood stream may greatly improve the clinical state. As the granulocytes continued to appear, the patient's general condition improved, even though sepsis was developing with extreme rapidity and wide distribution. While the granulocytes were absent, the patient appeared near death, in spite of the fact that at this time the septic state was still comparatively mild.

4. Roberts, Stewart, and Kracke, R. R.: Agranulocytosis, J.A.M.A., 95:780 (Sept. 13) 1930.

This case is particularly instructive because the patient was watched through recovery and recurrence. In May, she appeared even stronger than before her illness. She remained in hospital for observation and the blood picture was watched with care. The middle of May, with dramatic suddenness, within twenty-four hours, the white cell count dropped from 5,000 to 3,000 and the polymorphonuclear percentage from 34 to 10. Two days later, all polymorphonuclears had vanished from the blood stream. And yet this woman of 72 was as well as usual, mentally alert, cheerful and walking out doors. The situation is best expressed in the authors' own words: "We said nothing and looked on in amazement, when we realized that here was a woman in whom the marrow had stopped making granulocytes, in whom the granulocytes were gone from the blood stream, and yet she presented every evidence of health, strength and well being." This state of things continued for two days and then, in midmorning, up and seated in her chair, the patient wilted before the physicians' eyes. The tonsils and throat reddened and necrosis of the tongue appeared, and, five days later, the patient died after forty-eight hours of stupor. She had lived for seven days without a demonstrable polymorphonuclear cell in the blood stream. Culture of the blood was negative. In this case, it appears proved that the bone marrow disease was primary.

It would seem reasonable to consider that there is both a primary and a secondary form of agranulocytosis; in other words, that there is a disease which attacks the bone marrow the nature of which we do not know and which we call primary, but that the bone marrow may be affected secondarily in an exactly similar manner by infections and toxins whose origin we do know. As the effect of the

lack of mature polymorphonuclear cells in the blood became added to the original condition, the characteristic rapid necrosis of tissue followed. It is noteworthy that, in the majority of cases, the organisms obtained from the mucous membrane lesions and from the blood have not been such as would normally account for the virulence of the process. They have frequently been organisms that are not normally pathogenic.

Of 317 cases reported in the literature as "agranulocytosis," the German pathologist Uffenorde[5] has sifted out 248 as representing "pure" agranulocytosis. He found a history of infection or operation without complete recovery preceding the agranulocytosis in 16 per cent of these. In eight cases, the blood picture was known to have been normal before or at the beginning of the septic disease, so that the sepsis in these cases did not depend on the lack of protective cells in the blood; and it is reasonable to assume that it was responsible for the bone marrow deficiency that was presently manifest.

The picture of agranulocytosis can follow poisoning with chemicals, especially arsenic and benzene. It has been reported after arsenical treatment of syphilis. It likewise can follow overirradiation with roentgen rays or radium.

Among the cases in which the blood changes appear to be referable to an infection, those that have followed extraction of teeth are of particular interest to the dental profession. They would seem to be fairly frequent, since, in a cursory review of only a portion of the most recent literature on agranulocytosis, I have found eighteen cases in which the condition developed after extraction of a tooth.

Two cases reported by Hill[6] are particularly interesting from the fact that a blood count was made just previous to the extraction and was found normal. In one of these, the teeth extracted were vital. The roentgen rays had revealed no indications of apical infection, but the patient had sciatica, and the teeth, lower molars, were impacted, the dentist having advised their removal. The extraction resulted in considerable trauma. On the seventh day, there was hemorrhage from one of the tooth sockets and, on the tenth day, the temperature rose to 100 degrees and a blood count showed 2,000 leukocytes with not one polymorphonuclear. The mouth lesions were chiefly confined to the cavities of the extracted teeth, where the tissue became gangrenous. Gangrene also appeared on the external genitalia. The white cells dropped to 200, 100 per cent lymphoctyes. The patient died fifteen days after the onset of fever, twenty-five days after the extraction.

In the second case, eight infected teeth were removed from a patient who had recently had extensive herpes zoster and who was suffering from "mental exhaustion." Fever and a toxic state followed the extraction, and an exudate giving off a gangrenous odor formed on the gums along the line of extraction. The blood count showed 3,600 white cells with 3 per cent polymorphonuclears. The patient recovered. In each of two cases reported by Jackson *et al.*,[7] a small ulcer was noted on the gum at the time of tooth extraction. No blood count had been made previous to removal of the teeth. In the case reported by Richards and

5. Uffenorde, Hellmut: Ausgedehnte Nekrotisierungen des Verdauungsschlauches bei Agranulocytose nebst Bemerkungen über die ursächlichen Bedingungen dieser Erkrankung, Virchow's Arch. f. path. Anat., 287:555, 1932.

6. Hill, H. P.: Acute Leukemia and Agranulocytic Angina Associated with or Following Removal of Teeth, California & West. Med., 25:609 (Nov.) 1926.

7. Jackson, Henry, et al.: J.A.M.A., 97:1436 (Nov. 14) 1931.

Ikeda,[8] the patient had had a suppurative adenitis with a leukocyte count of 3,500. One month after healing of the adenitis, an upper molar was extracted, and, within twenty-four hours, the gums, throat and palate were swollen and painful. Two days later, there was profound prostration and a leukocyte count of 4,300 with only 4 per cent polymorphonuclears, and the gum at the site of extraction was gangrenous. In this case, the low white cell count at the time of the suppurative adenitis and the fact that only three days after the extraction the polymorphonuclears were reduced to 4 per cent indicate that the bone marrow function was deficient before extraction was performed.

Another case interesting to the dental profession is one of agranulocytic paradentitis recently described by Bauer.[9] This was secondary to treatment with neo-arsphenamine. The white cells numbered 2,800, 23 per cent of which were polymorphonuclears. There was rapidly progressing necrotizing inflammation of the paradentium with extensive alveolar destruction.

The usual termination of agranulocytosis is death in the first attack. If the patient recovers, further attacks are likely to occur. Cases running a chronic course have also been reported.

In therapy, blood transfusions, applications of roentgen rays to the long bones, and use of leukocytic extract, liver extract, fetal spleen and pentose nucleotides have all been used, with irregular results. The last named remedy seems at present to offer the most hope. The main effort must be to stimulate the bone marrow to produce granular cells quickly enough to prevent a fatal sepsis from developing. Spontaneous recoveries occur, but are rare.[10]

8. Richards, E. T. F., and Ikeda, Kano: Agranulocytosis, Minnesota Med., 16:299 (May) 1933.

9. Bauer, Wilhelm: Paradentitis Agranulocytotica, Ztschr. f. Stomatol., 31:1 (Jan. 13) 1933.

DISCUSSION

E. C. Hume, Louisville, Ky.: The subject of agranulocytosis should be very interesting to all members of this organization. The manner in which any disease attacks, if suddenly, as in some instances, adds to the interest of those who attempt to treat it and to the distress of the patient and members of the family. The diagnosis of agranulocytosis can be confirmed only by the microscope. Dr. Schaefer has detailed to us how it is possible for a patient to be ambulatory, perhaps visiting his dentist for tooth extraction or other dental work, or even going about his business, and within a few hours be in an extremely grave condition with possibly the family believing the cause of illness to be the fact that the patient had had teeth removed. To quote Dr. Schaefer's figures, eighteen cases followed the removal of teeth. This is very embarrassing to the dentist until sufficient laboratory work has been done to reveal the true cause of the illness. Just what changes occur in the marrow of the long bones which produce the deficiency of cells is at present not known. Whether production is lessened or completely stopped before other symptoms manifest themselves in the mouth and throat is debatable. There

10. In addition to Footnotes 2, 5, 6, 7 and 8, the following articles contain mention of cases of agranulocytosis following extraction of teeth: Fitz-Hugh, Jr., Thomas, and Comroe, B. L.: Agranulocytic Angina (Pernicious Leukopenia), Am. J. Med. Sc., 185:552 (April) 1933. Corrigan, W. J.: Staphylococcal Infection Accompanied by Agranulocytic Leukopenia, Canadian M. A. J., 27:248 (Sept.) 1932. Dimmel, H.: Formen der Agranulocytose. Fol. Haematol., 49:411 (March) 1933 (An account of two attacks of agranulocytic angina occurring in the same patient following treatment of a dental fistula, with the statement that this connection has been noted a number of times in the literature).

is evidence on both sides of the argument. The fact that the normal blood picture can undergo such radical changes within a period of four days, an extremely interesting phenomenon, makes it necessary that whatever therapeutics are applied must act promptly in starting production of new cells if the patient's life is to be saved. My personal knowledge of this subject is very limited, being based on only four cases, two of which ended in death. In one of these the patient lived ten days without a polymorphonuclear cell, according to the physician who treated her. The other two patients apparently have made good recoveries. The hospital records of these cases are very similar to those quoted by Dr. Schaefer. Three of these were treated almost exactly alike, namely, with roentgenray irradiation over the long bones and blood transfusion, care being given to the mouth and throat. One patient recovered and two died. The one recovering has apparently been entirely well for a period of twenty-six months. Repeated blood counts during this period have been normal. The fourth case, a more recent one, which I had an opportunity to observe, was treated entirely with pentose nucleotides and local care of the mouth and throat, the same as in the other cases. The patient has apparently been well for a period of two months, during which time repeated blood counts were found to be normal.

As to the effectiveness of the various methods of treatment, one can readily see that no 100 per cent effective treatment is known. Certain internists suggest a combination of nucleotides, roentgen rays and repeated blood transfusion, the transfusions to tide the patient over, if possible, the period of inactivity of the cell-producing power of the bone marrow. An extremely interesting feature of agranulocytosis is that it is apparently on the increase, and this should make us more thorough in history taking and in examination of the mouth and throat in order that early symptoms may be detected and that more laboratory work may be done in suspected cases and thus greater service be rendered our patients. I realize that it is impossible for the average exodontist to have a blood count in all cases, yet if that were possible, it would, in many instances, be extremely beneficial to the patient and save us much embarrassment. Any operative procedure on the tissues of the mouth of a patient suffering from agranulocytosis should be carried out only after consultation and with extreme caution. It is easy to understand that this is true because of the apparent ease with which the tissue becomes necrotic without trauma and the utter impossibility of any operative procedure being carried out without a minimum amount of trauma to the surrounding tissue.

Floyd E. Straith, Detroit, Mich.: I would like to ask Dr. Schaefer what the longest time has been before a recurrence? Many of you possibly knew Dr. Milton Watson. He had a very serious attack and was ill a long time four or five years ago. He died a month ago of a second attack and had had no recurrences during that time.

Theodore Blum, New York City: Have you ever seen a case which was not gangrenous?

Dr. Schaefer: I have only seen four or five cases and these were all gangrenous.

Theodor Blum, New York City: It is some time since we saw the first case of agranulocytosis and we were even in a worse position then than we are now. We did everything possible. We even called on the Rockefeller Institute, which could not help us. Since then, there has been some improvement in the treatment, as Dr. Schaefer has told you. In one case, on which I was called in, there was no sign of ulceration or gangrene. It appeared as a case of hypertrophy of the gum tissue, very marked, except that the tissues were very much blanched. The hypertrophy had extended into the sockets of the teeth so the teeth themselves were raised out of the sockets and the patient was not able to close the teeth for masticating. It was a case that had been going on for six weeks when I first saw it. The interesting thing was that we had to decide at the time for the convenience of the case to remove one molar so there would be better occlusion,

and fortunately we were able to examine the tissues. Part of the soft tissues came out during the extraction. This is, I believe, unique in a case of this type. In most cases, we find ulceration and gangrene. Whenever we see cases of gingivitis which are not due to, as very often can clearly be seen, dirt and apparently unhygienic conditions, we should without hesitation proceed with a clinical examination or clinical-pathologic examination of the blood to determine at the start whether we are dealing with an ordinary case of gingivitis or stomatitis or are dealing with one of the more serious cases such as Dr. Schaefer has described.

TREATMENT OF FRACTURES OF THE MAXILLA, MANDIBLE AND OTHER BONES OF THE FACE*

By PAUL J. AUFDERHEIDE, D.D.S., Cleveland, Ohio

FRACTURES of the mandible and bones of the face have been on the increase for the last twenty years owing to the great amount of machinery used, the steady increase in the number of automobile accidents on our overcrowded streets and roads and the great volume of building that has been done.

In these fractures, one has to worry not only about union and function, but also about the appearance of the patient after healing, as the face plays such an important part in personality and the various factors that are so important in the patient's future. Establishing a good occlusion is very important, both for appearance and for efficient mastication of food.

All these important factors require an exacting and thorough course of treatment by the surgeon having charge of the case. A higher class of person has been receiving treatment for this type of fracture, and this class demands the best esthetic results. The automobile has brought this group of persons into the field of treatment. This necessitates a very intimate study by the doctor of the causes, treatment, complications, prognosis and method of healing in these cases. Each one presents a different problem, and the success of the result is in direct proportion to the ingenuity and resourcefulness of the operator. In other words, selecting and making the proper appliances and seeing that they are keeping bone and facial relationships normal is a study in itself, and plays an important part in a successful prognosis.

The treatment of fractures of the mandible involves the same fundamental principles as that of all other bones; namely, reduction, stabilization of fractured parts and control of inflammatory processes. Fractures of this bone offers the following disadvantages over most other fractures as regards treatment.

1. Many are compounded into the mouth, which keeps the area constantly irrigated with infected saliva.

2. Drainage is usually against the force of gravity.

3. Fractures of the mandible are often followed by a severe cellulitis of the submaxillary region, the seriousness of which we all realize.

4. They are often accompanied by an osteomyelitis, which results in a delayed union.

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 10, 1933.

5. Compound fractures in most other bones can be protected from additional outside infection by sterile dressings, a thing that is impossible in the mouth.

6. They are very uncomfortable to the patient in such necessary acts as swallowing and breathing and in reflex acts such as sneezing and coughing.

7. The muscle pull is against the forces or appliances that are attempting stabilization.

8. Direct bone wiring is only practical in a few selected cases, because these fractures become infected very easily.

9. The mouth has all the requirements for the growth of bacteria; namely, darkness, warmth and moisture.

10. Feeding must be considered, and this is done with difficulty quite often.

Fig. 1.—Left: Fracture of both necks of condyles. The last molars hit and there is a space between the anterior teeth. Right: Interdental wiring employed to pull the teeth up in occlusion and to stabilize them.

The causes of the cases are: (1) arguments between well meaning friends under the influence of alcohol; (2) arguments that are in earnest; (3) industrial accidents; (4) various types of athletics; (5) pathologic fracture caused by osteomyelitis, necrosis and the presence of large cysts, carcinoma or sarcoma; (6) occasionally, surgical procedures, such as removal of badly impacted third molars; (7) gunshot wounds of the face, and (8) last, but not least, automobile accidents.

The fundamental classification of fractures of other bones applies likewise to the bones that we are dealing with.

The symptoms are the same as for other fractures; namely, displacement, crepitus, pain, swelling, loss of function and an additional symptom which other bones do not present, malocclusion of the teeth. The last named is a very important diagnostic symptom, and extremely valuable in successful treatment.

DIAGNOSIS

There is usually some degree of displacement in all fractures of the mandible, except certain ones in the symphysis

Fig. 2.—Pathologic fracture due to carcinoma.

(between the cuspids), an occasional fracture of the ramus and green stick fracture. In these cases, many times, the muscle tension is equalized. In unilateral fractures of the neck of the condyle, the posterior teeth on the same side as the fracture usually are the only ones touching. In bilateral fractures of the neck of the condyle, the posterior teeth on both sides will touch, leaving various degrees of space between the upper and lower anterior teeth. In both cases, this is caused

by overriding of the fractured ends. Occasionally, in fractures of the mandible, a fracture of the tympanic plate is present, and the patient may have a wound compounded into the auditory canal, with resultant bleeding from the ears.

Fractures in the ramus with overriding of fractured parts present the same malocclusion symptoms as fractures of the neck of the condyle.

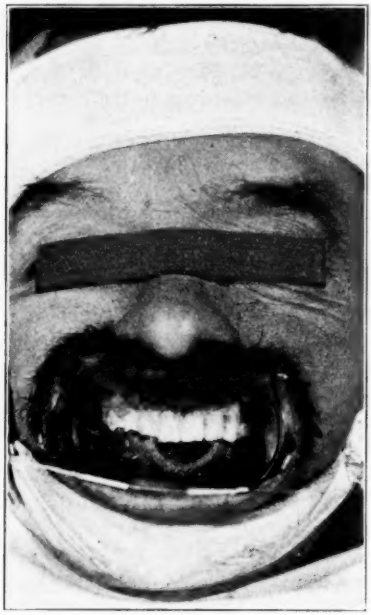

Fig. 3.—Edentulous case. The patient had an upper denture and there was not much displacement. The lower splint was made of strong baseplate and modeling compound, and a headgear and a chinstrap were used to stabilize. A hole was cut in the splint to allow feeding with a tube.

The displacement is usually in direct proportion to the amount of force causing the fracture.

In fractures of the mandible occurring between the second molar and the cuspid, the posterior fragment is pulled upward by the temporal and masseter muscles, and inward by the internal pterygoid and mylohyoid muscles. The anterior segment is pulled downward by the hyoid group of muscles and the anterior belly of the diagastric.

In many cases, we find two fractures, one caused by direct violence; for example, in the left bicuspid region; and one caused by indirect violence; for example, in the right neck of the condyle. This is an important consideration in diagnosis and helps to eliminate the possibility of missing other fractures.

The history of the case is always a very valuable aid in diagnosis.

The roentgenogram, and especially the stereoroentgenogram, is a very valuable aid in determining: (1) the location of fractures; (2) the amount of displacement; (3) the angle of fractures, which helps in outlining the reduction; (4) the position of segments; (5) the relation of teeth to the fracture; (6) the location of fractured teeth; (7) the relation of fractured parts after stabilization; (8) the progress of healing, and (9) the presence and location of any disease conditions.

Before the reduction of fractured parts is attempted, it is good judgment to consider the physical condition of the patient.

Such items as shock, pneumonia, fracture of other bones, internal injuries, a previously existing tuberculosis, syphilis or diabetes must all be considered if the patient is going to receive the most efficient service.

TREATMENT

The most common means of stabilization of fractured parts are: 1. Metal splints (cast or swaged) cemented on the teeth. 2. Heavy wire arches wired directly to the teeth, together with interdental wiring. 3. Inderdental wiring. 4. A combination of interdental wiring and metal

splints. 5. Bandages, such as Barton, four tail and caps of various types with chin straps attached. 6. In edentulous cases a headgear and chin strap used after the patient's dentures are inserted. 7. Direct bone wiring.

The most efficient of these in my hands is interdental wiring, occasionally in combination with arch wires or some type of metal splint. In some cases, when there are teeth on each side of the fracture or fractures, interdental wiring may be used for a short time and then a metal splint may be employed, that the patient may "carry on" more efficiently. The splint is cemented on the teeth, thus allowing the patient to open and close for conversation and eating.

When there is great displacement, it is good policy to reduce the fracture slowly over a period of three or four days, as there will be less inflammatory reaction experienced.

Fractures through the third molar or posteriorly to the last tooth present a problem as to keeping the ramus in place. This is important, as any patient may be a prospective denture case. A splint with a lug that engages the ramus in the retromolar triangle, together with interdental wiring, will keep the posterior segment down. A crown can be made for an upper second or third molar with a lug soldered on, which engages the ramus the same way, and this with interdental wiring will keep the segment down.

In edentulous cases, the patient's dentures can be inserted and a chin strap and headgear used to stabilize. If the patient has no dentures, some can be made, or a modeling compound splint can be made with a hole in the front for feeding. These cases present problems and complications as to normal apposition and stabilization.

Occasionally, a large chip of bone may be detached, such as the outer plate of the symphysis. This can be manipulated into place and kept there by drilling a bone bur through the detached segment into the main part of the bone. The bur is left in place until union occurs, and then removed with pliers, slowly.

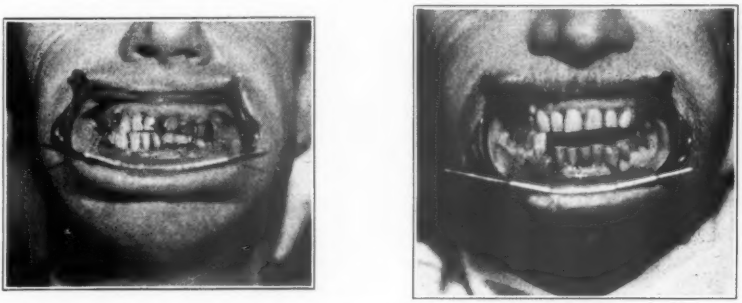

Fig. 4.—Left: Case before stabilization. Right: Case after stabilization with interdental wiring.

All conditions warranting, the sooner stabilization is accomplished, the fewer the complications experienced, and the more quickly union takes place.

Anesthetics are necessary occasionally for reduction and inserting stabilizing appliances.

Block anesthesia can be used when the operator is sure that it will not cause additional complications by infection. Sodium amytal, sodium biamytal and

other general sedatives are very efficient, keeping the patient from suffering a great deal during stabilization, and allowing the operator to work more efficiently owing to better cooperation on the part of the patient.

General anesthesia can be used for impression taking, cementing on splints and placing the loopes for interdental wiring. In the last mentioned treatment, the tie wires can be inserted after the patient recovers consciousness. It would be poor judgment to tie the upper and lower jaw together while the patient is under a general anesthetic, as nausea and other complications might develop, which would be detrimental to the patient's welfare.

Fig. 5.—Splint with lug engaged in retromolar triangle to keep posterior segment down.

COMPLICATIONS

The four most common complications experienced are infection of soft tissues, osteomyelitis, deformities and nonunion. Six measures are essential to combat infection in cases compounded into the mouth:

1. Diligent irrigation with an antiseptic solution which is also a deodorant, such as potassium permanganate 1:7,000; also thorough cleansing of the oral cavity every few hours with a cotton swab and friction.

2. Stabilization of fractured parts as soon as is practical so that the mucous membrane can heal and seal off secretions from the mouth.

3. Removal of foreign bodies in the line of fracture, such as roots, as soon as practical.

4. Removal within approximately two weeks of teeth that have lost the peridental membrane attachment to the apex, with devitalization of the tooth. This is governed somewhat by the position of tooth and the location of the fractures.

5. Removal of abscessed teeth in the line of fracture as soon as practical.

Cold applications, extra-orally, should be applied immediately at points of fracture. If the swelling is going to point outside, hot applications are indicated.

When localization of pus exists, incision and drainage is necessary. Rubber drains are more effective than gauze.

Chronic fistulous openings should be treated with phenol sulphonic acid, used sparingly. This will hasten sequestration and destroy the chronically inflammatory tissue which forms in these tracts.

Occasionally, in cases of slow union accompanied with some swelling, it is wise to use prophylactic drainage. This lightens the overload, helps Nature combat the existing infection and results in less destruction of bone and quicker union.

Where the bone is involved with osteomyelitis, it is folly to curet too soon and folly to wait too long. When sequestration does not take place within from two to three weeks, curettage done judiciously will shorten the time of union greatly. Consideration must always be given to proper drainage, since, if it is lacking, we are always inviting a spreading of the infection in the osseous structure adjacent to the fractured ends.

No doubt, we have all seen many patients lie around hospitals from one week to two months without attention to fractures of the bones with which we are deal-

ing. This is neglect, and it is the duty of the dental staffs of all hospitals to educate the medical staffs as to the importance of seeing these cases early. We have all seen attractive looking women and men of

gical work, but this is done only after all infection and inflammatory processes have disappeared, usually in about six months.

Nonunion is a serious complication, as it is difficult to use direct bone wiring or

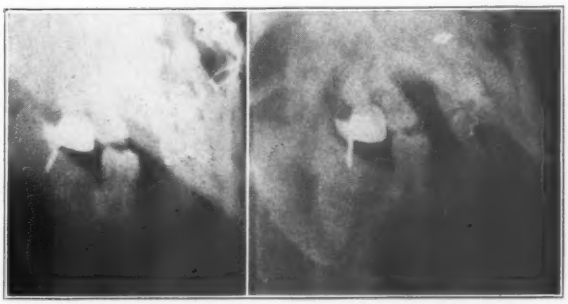

Fig. 6.—Crown on upper last molar with lug engaging in retromolar triangle holding posterior segment down. (Missed in film to left and replaced in film to right.)

Fig. 7.—Third molar fractured and in line of fracture of mandible, left in until fibrous union took place, then removed to minimize chances of infection. The posterior segment is down in place.

ability with bad deformities and occlusions which could have been rectified easily at an early date after accident.

Deformities in the soft tissue or osseous structure can always be repaired by surbone grafts later, owing to the possibility of infection. Occasionally, this is caused by parts of muscles getting in between fragments; which cannot always be prevented. Removing stabilizing appliances

and causing vigorous movement of fractured ends with the hands will sometimes cause rarefaction of ends and a new blood clot to form, which will assist in union.

Removing appliances when there is a little movement, provided apposition is correct, and there is fibrous union, will often cause enough stimulation to result in calcific union where there is only partial fibrous union at the time. I have had two cases at the angle of the mandible with no osseous union, which I have left alone, as they have remained in good position and there was little movement at the point of fracture, and the parts function satisfactorily.

Quite often, patients get a sprain of the ligaments of the cervical vertebra, causing considerable soreness of the neck. This is to be expected, but one should always consider fractures of these bones also.

Many of the cases of fracture, particularly of the upper and lower jaw, are referred directly to the dentist, and if there are any symptoms of other complications, it is imperative that proper medical men be called on the case to give the patient honest service.

Concussion is expected in many cases, and it should be treated by rest in bed, and the regular routine treatment.

Occasionally, one may see one tem-

Fig. 8.—View of entire mandible, which is very helpful (taken down through head as for sphenoidal sinus film).

Fig. 9.—Sequestrum. Sequestration sometimes happens with direct bone wiring in fracture of the mandible.

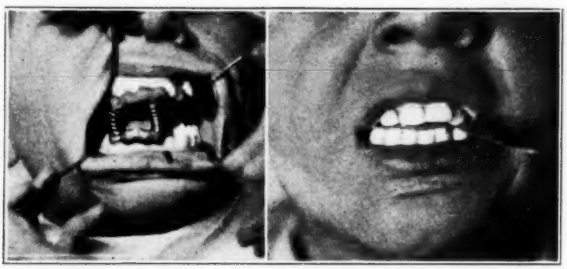

Fig. 10.—Limited motion following bilateral fracture of necks of condyles. The castings on the upper and lower teeth have springs inserted between them.

poromandibular articulation traumatized (without a fracture) with enough edema to cause the head of condyle to be displaced anteriorly. This will cause the teeth occlude anteriorly from the normal position. Interdental wiring will force the head of the condyle back to allow normal occlusion and permit the socket to heal so that the condyle will always remain in normal position. If this is not done, it is always possible that the lower jaw will occlude anteriorly from its normal position.

Fig. 11.—Fracture of symphysis in young boy in sleigh accident. The continuity of the mandible was not broken as there was little of the lingual plate left.

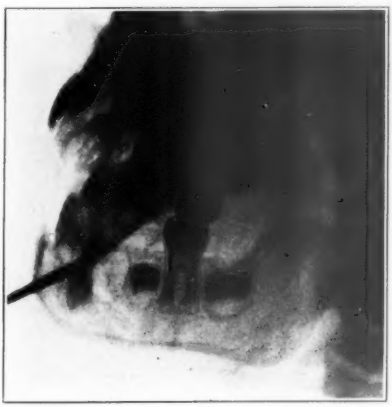

Fig. 12.—Bone bur in place, holding fragment to lingual plate.

teeth to articulate to the opposite side. It might be bilateral, and the entire mandible be displaced forward and all lower

In fractures of the neck of the condyle, where the head is pulled a little forward, owing to the pull of the external pterygoid muscle, the case is treated as if the condyle was back in the normal position. This applies also when the head of the condyle is displaced anteriorly to the eminentia articularis. Practically always, union is obtained and function is close to the normal.

Fig. 13.—Bandage holding bur in place.

In cases of fracture in the region of the condyle, with traumatization of the miniscus or the surrounding tissue, early movement is necessary to obtain good function. If the case is stabilized too long, very

limited function and even ankylosis may be experienced.

One very interesting case sent to me for consultation had a half inch prognathism. The question in the patient's mind was whether anything could be done to rectify the condition. He was 42 years old, and I advised leaving it alone. Two years later, my partner had the privilege of treating this case for a bilateral fracture of the neck of the condyle and transverse fracture of the symphisis. The displacement allowed him to pull the teeth into normal occlusion with interdental wiring. The result was a fairly normal occlusion and a normal profile.

Fig. 14.—Side view of case shown in Figure 13.

Ruptured blood vessels are handled as in any other injury.

Numbness of the chin is often experienced on the side of fracture. This may be due to: 1. Pressure of the fractured parts against the nerve. In this event, sensation should return within two months. 2. Severing of the nerve at the fracture line. In this event, sensation should return in eighteen months. In either event, the patient has a feeling of discomfort, due to loss of epicritical sensation.

PROGNOSIS

The time of union varies greatly according to type and location of the fracture. Simple fractures, not compounded into the mouth, may have enough union in three weeks to allow removal of appliances. On the contrary, a fracture that

Fig. 15.—Lateral view, showing end-result.

Fig. 16.—Anteroposterior view, showing end-result.

has been compounded into the mouth with a great deal of displacement, together with a destructive infectious process, may take four months or more before union occurs.

The following systemic factors are also to be considered: (1) tuberculosis, syphilis, and diabetes, which usually mean a slow union; (2) in children, rickets, which should be treated accordingly. Activators and proper diet have their place in all cases wherein there is delayed union.

The problem of feeding is largely dependent on the tolerance of the individual. When splints are used, the patient roughage and constipation might result.

The following facts deserve consideration.

1. When the external force is great, some of the cancellous bone is crushed and loses its blood supply, thereafter acting as a foreign body which delays union.

2. Curettement, at the proper time, to remove this bone, or sequestrum, will help greatly to minimize the time of union.

If these conditions are neglected, they cause destructive infection to fractured ends, and might double or triple the time of union.

3. Age plays an important part. In the case of a child, union may be obtained

Fig. 17.—Emergency bandage of wrong type, causing more displacement when swelling takes place.

can usually open the mouth and all foods can be eaten and masticated. When interdental wiring is used, the patient has to live on a liquid diet, unless there are some missing teeth, in which event many types of solid food can be pushed through the apertures.

The liquid diet should contain sweet milk, buttermilk, eggnogs, broth from soups and vegetables and plenty of orange juice. Elimination should be watched, as the patient does not receive much

in two weeks; whereas, the same type of fracture in a patient 60 years of age may take six weeks for union. All things being equal, the time of healing has a direct ratio to the age of the patient.

Fractures of the maxilla are usually simpler to treat than most factures of the mandible, because: 1. Gravity permits better drainage. 2. Muscle attachments do not counteract the force of appliances used in treatment as they do in the mandible.

The diagnosis is made as for fracture of the mandible, occlusion being the basic factor.

Treatment when both maxillae are fractured, with little or no displacement, consists of the use of a headgear and chin-strap bandage, or a Kingsley splint attached to a headgear. Sometimes, no appliances are necessary.

In this type, the line of fracture is usually through the floor of the antrum and of the nasal cavity, or through the alveolar process just below the floor of the

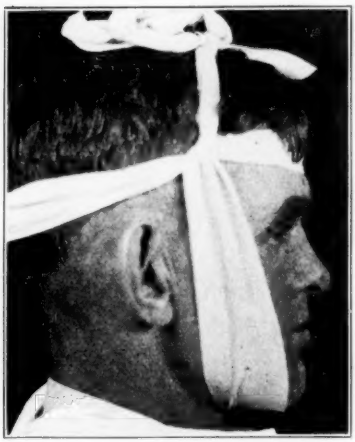

Fig. 18.—Correct type of emergency bandage. The pull is straight up.

nasal cavity. In bilateral fractures of the maxilla, both antrums are usually full of blood. In unilateral fractures, one antrum is so involved. This blood usually liquefies and drains. Occasionally, the antrum may become infected and is treated accordingly. Roots or teeth occasionally forced into an antrum should be removed when the initial inflammation, due to the trauma, subsides.

When there is considerable displacement posteriorly, use of a baseball mask, with rubber bands attached from appliances on the teeth to the wire of the mask, will usually bring the displaced maxilla forward to the normal position.

If only one maxilla is loose, and is displaced downward, interdental wiring on the uninjured side will force the injured side to place and stabilize it. If the loose maxilla is displaced backward or forward, interdental wiring is used on both sides; on the uninjured side to stabilize, and on the injured side to pull the displaced maxilla into the normal position, and the teeth into normal occlusion.

Small sections, including from two to five teeth, can be held in place, either with splints cemented on the teeth or by interdental wiring at uninjured sections of the maxilla.

Many of these cases are caused by automobile accidents. If the automobile hits a stationary safety stanchion, there is usually considerable displacement of bones experienced, together with involvement of some of the other bones of the face, such as the malar, zygomatic arch, nasal and floor of orbit, and occasionally through the cribriform plate. When the cases involve the anterior cavity of the brain at any place, it is best to delay manipulation until the danger of meningitis is passed. Overenthusiasm in this type of case may result in trouble.

The zygomatic arch and the malar bone frequently can be manipulated to normal position intra-orally with the fingers, the open reduction method, which always increases the possibility of infection, being thus avoided.

When the zygomatic arch and malar bones are displaced, we usually find a separation of the suture between the temporal and the malar bones, fractures in the floor of the orbit, a fracture through the infraorbital foramen and fracture of the zygomatic surface of the maxillary bone.

In manipulating, it is good judgment

to hold a finger against the infra-orbital margin so that this part of the bone does not come too far forward.

Owing to induration of orbital tissues in these cases, the extrinsic muscles of the eye do not function normally, and the eye of the affected side will not follow a finger in all directions so well as the other eye.

It is good judgment to wait a few days until swelling disappears before any manipulation is done. In cases involving the nasal cavity, it is best to work with a rhinologist, as the presence of hematoma, a fractured septum and displaced turbinates and similar complications need immediate consideration.

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SURGICAL TREATMENT OF TRIGEMINAL NEURALGIA*

By LOYAL DAVIS, M.D., Chicago, Ill.

ONE of the most interesting facts about neurologic surgery is that it has many points of contact with other fields of medicine and surgery. That case of trigeminal neuralgia is rare which is not seen at some time during its course, and usually early, by the dentist. It is not strange that the patient with pain in his face should attribute the difficulty to his teeth.

Until it was recognized as a clinical entity, tic douloureux, or trigeminal neuralgia, was a part of that large group of cases diagnosed rather indefinitely as facial neuralgia. On the two pillars which face the south aisle of the choir within the Wells Cathedral in Somerset, there are three carved figures which are illustrations of persons suffering with violent facial pain. One is of a monk with an open mouth, with tongue protruding and distorted features indicating severe agony. These figures bear witness to the offerings to the cathedral funds by pilgrims who came to the tomb of Bishop Button. The offerings which helped furnish the cathedral were made at his tomb by sufferers from toothache and neuralgia, who came in large numbers to be cured by his saintly influence. The bishop's reputation for curing toothache and neuralgia may be explained by the fact that although he died in very old age, he had a perfect set of thirty-two teeth with no trace of caries or discoloration. Since Bishop Button's day we have divided the responsibility of treating toothaches and that specific type of facial neuralgia, tic douloureux.

Though this painful and intractable disease of the face may have been known, it was not described as an entity until John Fothergill wrote his monograph, "On a Painful Affection of the Face" in 1776. So it has become known, among its many other names, as Fothergill's disease. Like many other diseases in medicine and surgery, Fothergill's original description has been improved on but little. He said,

> This affection seems to be peculiar to persons advancing in years, and to women more than to men. I never met with it in anyone much under forty, but after this period, no age is exempt from it.

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 11, 1933.

From imperceptible beginnings, a pain attacks some part or other of the face, or the side of the head; sometimes about the orbit of the eye, sometimes the ossa malarum, sometimes the temporal bones, are the parts complained of. The pain comes suddenly and is excruciating; it lasts but a short time, perhaps a quarter or half a minute, and then goes off; it returns at irregular intervals, sometimes in half an hour, sometimes there are two or three repetitions in a few minutes.

The kind of pain is described differently by different persons, as may be reasonably expected; but one sees enough to excite one's compassion if present during the paroxysm. . .

Eating will bring it on some persons. Talking, or the least motion of the muscles of the face, affects others; the gentlest touch of a hand or a handkerchief will sometimes bring on the pain, whilst a strong pressure on the part has no effect.

It differs from the toothache essentially in many respects. It affects some who, from age, have few or no teeth remaining. . . .

In cases of singular difficulty and obstinacy, it is natural for us to be inquisitive into their causes and their nature; unsuccessful experiments sometimes lead the way to instruction; and we ought never to cease investigating the most abstruse recesses of nature, nor at the same time forget the narrow limits of our capacity, and the danger of presumption.

In addition to our inability to add further to Fothergill's description of trigeminal neuralgia, we are unable to add to his knowledge of the etiology or pathology of this disease. His observation of fourteen cases led him to suggest that it was due to carcinoma. Perhaps he would view our surmises as to the etiologic factors involved with as much incredulity. It is true that many patients have foci of infection in the teeth, tonsils or other organs, and that some have hypertension cannot be denied; but the relief of any or all of these suspicious etiologic agents fails to cure the excruciating facial pain with which the patient suffers.

Likewise, intensive and well-controlled histopathologic studies have been made of the gasserian ganglion, sensory root and peripheral divisions; but, as yet, no clue is in our hands as to the nature of trigeminal neuralgia.

While, in many diseases, therapeutic empiricism is fraught with danger, in this instance, therapy has far outstripped our knowledge of the fundamental facts. We shall, therefore, concern ourselves with the story of the methods of treatment and their results.

The question arises immediately as to whether medicinal treatment, alcoholic injections or surgery should be advised. It is true that in an occasional case, the severity of the early paroxysms is slight, but in the majority of patients, drugs fail to control the excruciating pain. The usual analgesics, acetyl salicylic acid, acephenetidin and antipyrine are of little value, though in combination with other hypnotics, they may afford some slight relief. Even morphine alone does not help, but, in combination with hyoscine, may afford temporary relief and produce sleep. In some instances, inhalations of trichlorethylene may be of help, although it has been our experience that, as time goes on, relief becomes less sure or complete.

In 1890, Rose excised the maxilla, trephined the base of the skull with the foramen ovale as a center and curetted away the ganglion. At about the same time, the elder Edmund Andrews, among others, exposed and excised the ganglion through the pterygoid fossa. These radical operative steps were followed by an extremely high mortality. In the discussion of Rose's paper, Ferrier said: "The pathology of neuralgia is obscure and in many cases it may be of central origin. Section of the nerve above the ganglion may cause an ascending degeneration and thus lead to relief by producing atrophy of the center." It is presumed that Ferrier meant sectioning of the sensory root with atrophy of the center in the pons or higher.

In 1891, Horsley, Taylor and Coleman suggested division of the trigeminal nerve posterior to the gasserian ganglion. Horsley performed the operation on a patient in whom the inferior dental and infraorbital nerves had been removed previously, and although he stated that "the operation presented no special difficulty beyond that of being very tedious," the patient died seven hours later of shock.

In 1892, Hartley and Krause simultaneously advocated an approach through the temporal bone by means of an omega-shaped flap of skin, muscle, periosteum and bone. This procedure was known as the high temporal operation, in contradistinction to the method proposed first by Cushing and later by Lexer, in which the line of incision was somewhat lower. These suggestions concerned only the means of reaching the ganglion to excise or avulse it. Because of the high mortality resulting from avulsion of the ganglion, operative procedures were limited for a time to division of the peripheral branches involved. As such incomplete measures were almost always followed by regeneration of the avulsed nerve and by attacks of pain in one of the remaining branches, further surgical measures became necessary.

In November, 1898, Spiller said:

> If it could be shown that the sensory root of the Gasserian ganglion does not unite after its fibers are divided, we should have a fact of great importance. Division of this root would probably be a less serious operation than the removal of the entire ganglion and might have the same effect in the relief of pain, but the surgical difficulties might be insurmountable. Experiments on animals to determine whether or not the sensory root of the Gasserian ganglion unites after section of its fibers might result in a lessening of the great mortality now existing in operations on the ganglion.

In order to place the operation of division of the sensory root on a sound foundation and to exclude the possibility of regeneration of the sensory root after division, seven specimens of the gasserian ganglion and its roots, removed from as many dogs, on which division of the sensory root had been performed by Frazier, were examined by Spiller. In 1901, Frazier carried out this operation on man, and it was shown conclusively from an experimental and clinical standpoint that regeneration of a completely divided sensory root never occurs.

At about this time, when the mortality of surgical procedures was admittedly high and when the conclusive evidence of Spiller and Frazier was not yet accepted widely, Pitres and Verger, and subsequently Schloesser, advocated alcohol injection of the deep foramina of exit of the three divisions of the trigeminal nerve from the skull. The effect of the alcohol injection is to produce local destruction, by coagulation, of the nerve fibers at the point of injection. This is followed by degeneration below that point to the periphery. As long as the cells of origin within the ganglion are intact, a new nerve fiber will begin to grow downward and conduction within the nerve may be expected within from a few months to two years. Schloesser's original method was to inject the foramina from within the mouth. The needle was passed behind the palate through the roof of the pharynx. In 1906, Levy and Baudouin described the method of injecting the foramen ovale and foramen rotundum through the outside of the cheek, the method in use today.

At present, surgical approach to the gasserian ganglion and sensory root is made through the temporal bone at the level suggested by Cushing and Lexer. The incision is a longitudinal one, extending upward for about 3 inches from the preglenoid tubercle on the zygoma. A simple trephine opening is made through the squamous portion of the temporal

bone and this is enlarged with bone-biting forceps. The method of making a large flap of muscle, periosteum and bone is quite unnecessary. The operative opening is enlarged downward as far as possible rather than upward, since the field is better exposed thereby and less retraction of the temporal lobe of the cerebrum is necessary. On raising the dura mater by wet cotton sponge dissection from the floor of the middle cranial fossa, it may become necessary to identify several landmarks. These are (1) the foramen spinosum, through which the middle meningeal artery enters the cranial cavity; (2) the foramen ovale, through which the mandibular division exits from the skull, and (3) the gasserian ganglion, with its sensory root.

Recent refinements in technic proposed by Frazier, Stookey and others have made it possible to perform a subtotal section of the sensory root fibers. If the pain has been limited to the maxillary and mandibular divisions, it may seem advisable to conserve the ophthalmic portion of the root. As we have shown, since the fibers of the root rotate in their course from the brain stem to the ganglion, and anastomose freely at the hilus of the ganglion, it is necessary to exercise care as to the exact point at which subtotal section is performed. Otherwise, fibers may be conserved in which pain has been present and relief may not be so nearly complete as is possible.

Another nicety in technic is that which conserves the motor root. This structure may be identified easily, and if the superior-medial edge of the ganglion is drawn downward and laterally, as Adson has suggested, the motor root will separate from the overlying sensory root quite easily.

Recently, another approach to the sensory root by a suboccipital craniotomy has been suggested, on the basis that section of approximately half of the sensory root near the pons results in complete relief of pain, with but slight sensory changes in the face. It has been shown experimentally in man and in animals that section of the lower half or third of the sensory root at its entrance into the pons always results in a definite loss of sensation, depending entirely for its distribution in the face on the amount of the root which is sectioned. Further, it has been shown that there is no topographic distribution of fibers in the sensory root which might be interpreted as an arrangement according to the type of sensation transmitted by them. Several surgeons have convinced themselves that the loss of sensation is identical clinically with that which follows section of the root near the ganglion. It would indeed be strange if such were not the case. The possible surgical accidents which may occur to the important cranial nerves in the posterior fossa which must be exposed is a matter not to be regarded lightly. Finally, several serious postoperative complications of irreparable damage to the cerebellum have been observed by various neurologic surgeons over the country.

While the last word concerning trigeminal neuralgia has not been said, it is necessary to go slowly before an operative procedure with a mortality rate of less than 1 per cent in the hands of well-trained neurologic surgeons is discarded.

There are certain complicating conditions which may be present after the operation, and these must be made plain to the patient. None of these conditions approach in gravity the excruciating pain which these patients suffer. I should say that in the order of their importance these complications are: (1) lesions of the cornea, (2) facial paralysis, (3) paresthesia, (4) difficulty in mastication, and (5) a feeling of fullness in the ear.

Involvement of the corneal epithelium following trigeminal sensory root section may result in a serious impairment of vision due to the resulting scar. It will be realized that sensibility of the cornea is absent as a part of the sensory loss in the entire trigeminal area of distribution.

Corneal lesions, in our experience, occur first as the result of an obvious direct injury to an insensitive cornea. Secondly, they occur in those cases in which a facial paralysis has occurred. Thus, an insensitive cornea is deprived of the normal protection and lubrication afforded by the palpebrum. These two types of cases are definitely preventable if proper and simple care is given the cornea. In the third group of cases, the corneal lesion occurs without direct injury to the cornea and in the presence of normal palpebral movements. In such instances, the corneal symptoms are manifest immediately after operation and occur regardless of whether the cornea is protected by a dressing. These are the most interesting cases and afford us a definite problem for study.

The symptoms which are found in this last group of patients are strikingly uniform and characteristic. The pupil becomes smaller and there is a definite narrowing of the palpebral fissure. Most striking of all is the dilatation of the veins of the sclera about the cornea. This picture resembles the circumcorneal injection which is always seen in an irritative lesion of the cornea in an otherwise normal eye. After an interval of from ten days to six weeks, these symptoms gradually disappear. Disappearance is hastened if the patient voluntarily keeps the eyelid closed as much as is possible. No other treatment is necessary; in fact, additional measures are decidedly hazardous.

It will be recognized immediately that these symptoms are exactly those of a lesion of the cervical sympathetic trunk. The only difference noted is that, in the latter cases, the time required for the disappearance of the symptoms has been longer.

According to Longet, Mayo, in 1823, first called attention to the fact that after a lesion of the trigeminal nerve the conjunctiva becomes inflamed, the cornea ulcerated and the cheek on the same side edematous. Fodera, Magendie, and Longet himself reproduced these findings experimentally by removing or destroying the gasserian ganglion. Later, Magendie sectioned the posterior root and found that these dystrophic changes in the eye either occured not at all or were very slow in their onset. On the contrary, they inevitably appeared if the ganglion was injured. Longet believed that these symptoms which followed injury to the ganglion were due to section of sympathetic fibers which pass from the carotid branch of the superior cervical ganglion to the glasserian ganglion. Claude Bernard did not support this view, but just what his clinical observations in the matter were we do not know. At any rate, he evidently changed his mind later, since he stated that removal of the superior cervical ganglion delays these symptoms by increasing the circulation and augmenting the vitality and resistance of the eye.

Sinitzin (1871) confirmed Bernard's last statements. He pierced the cornea of a rabbit with a glass thread, after removal of the superior cervical ganglion, and obtained no inflammatory reaction. In the control normal eye, he obtained an extensive conjunctivitis with iritis, and occasionally a panophthalmitis. Section of the fifth cranial nerve produced no corneal lesion when the superior cervical ganglion had been destroyed shortly before or after the section. Lastly, the corneal symptoms following trigeminal nerve section immediately disappeared if

the superior cervical ganglion was removed. These seemingly paradoxical results were denied by Eckhard and Sinftleben (1894) and confirmed by Spallitta (1894). We have repeated these experiments on cats and are able to corroborate Sinitzin's results in every detail. We were careful to section the posterior root without injuring the ganglion, and after this type of operation we occasionally obtained no corneal symptoms.

Many semilunar ganglions of cats have been studied histologically by Windle in conjunction with our experimental work. He made microscopic counts of the abundance and size of cells in the ganglions and of the size, number, and type of fibers found in the various peripheral branches of the fifth nerve. The ganglion of the trigeminal nerve chiefly contains unipolar cells of many sizes. It is interesting to note that the small cells are arranged in groups about the periphery of the ganglion, and, as Allen has shown, there is a particularly striking arrangement of such cells at the base of the ophthalmic division. These are the cells which give rise to thin, black, unmyelinated fibers. Windle found that, after removal of the superior cervical sympathetic ganglion, there was a loss of unmyelinated fibers in the long ciliary branches of the nasociliary nerve. These branches not only supply the radial muscle of the iris, but also innervate the cornea, which is sensitive to painful stimuli only.

These anatomic and histologic facts, while not entirely conclusive, suggest possible damage to sympathetic fibers at the time of operation as the causative factor in the type of corneal lesions under discussion. This occurs most probably from undue trauma to the ganglion or from unwise and unnecessary exposure of the ophthalmic division. Clinically, we have been impressed by the uniform presence of the symptoms of sympathetic trunk injury when we are dealing with a corneal lesion which is present immediately after operation and in which no direct trauma to the cornea has occurred. We have seen one instance of a herpes zoster ophthalmicus in which a Horner syndrome was present. These symptoms disappeared as the skin lesions receded. This observation would seem to add more evidence to an injury of sympathetic fibers about the ganglion.

We are accustomed to care for the cornea of patients in a definite manner after operation. Our methods are characterized by use of the natural protection afforded the cornea by the lids. We protect the eye during operation by guttapercha sealed to the skin with warm water. This is removed after operation and the patient is instructed to lie with his eyes closed. This order is rigidly enforced by the nurse for five or six days, after which the patient is asked to close the eyelids on the affected side more often than has been customary. The eye is gently irrigated each morning and night with sterile warm water. The patient is taught to do this so that we may feel assured that, when he goes home, he will not touch his cornea with gauze or cotton. We use no dressings of any description over the eye. They are difficult to hold in place and, to our mind, add a definite hazard to the safety of the cornea.

In the event of a facial paralysis, we suture the lids together immediately. It is almost impossible to keep the lids together by a dressing. With no facial paralysis, and yet erosion of the corneal epithelium, due perhaps to the presence of a foreign body or to direct trauma, we use 1 per cent yellow mercuric oxide ointment and put the patient to bed with the eyes closed and the room darkened. This rather enforced treatment is very effective in saving the patient from a

severe scarring of the cornea with impairment of vision.

Paralysis of the facial muscles following division of the sensory root of the trigeminal nerve occurs in from 3 to 5 per cent of cases. The paralysis may be present immediately after or it may appear some days after operation. It involves all the facial muscles on the affected side and is therefore peripheral in type.

Many explanations have been offered for the occurrence of this complication. It has been ascribed to trauma within the pons produced by avulsion of the sensory root and to the slow oozing of incompletely controlled bleeding. The explanation of Taylor has seemed most logical and certainly is based on anatomic fact. The greater superficial petrosal nerve crosses the petrous portion of the temporal bone and eventually is in close relation to the gasserian ganglion. This nerve arises from the geniculate ganglion of the facial nerve. It is not unreasonable to suppose that, in elevating the dura mater from the floor of the middle fossa, traction is exerted on this nerve, and this, in turn, is transmitted to the facial nerve as it lies within its canal. Certain it is that paralysis of the facial muscles has occurred only in those patients in whom the dura mater was particularly adherent. We have had less facial muscle involvement since using a technical step advocated by Adson in opening the dural envelope which encloses the ganglion.

In all of our cases, the facial paralysis has disappeared much as does a typical Bell's palsy. Massage and electrical stimulation of the muscles plus the use of small adhesive strips to keep the muscles from sagging have aided us greatly in obtaining recovery.

The peculiar feeling in the face which is experienced by patients who have been operated on offers the most trying complication for the surgeon to treat. Perhaps that is because his training in psychotherapy is usually rather deficient.

These cases of paresthesia complained of include burning and sticking sensations in the conjunctiva, a feeling described as that of the face held in a plaster cast, formication, numbness and coldness. It may be easily recognized that descriptions of the resulting sensory loss and the severity of the discomfort produced depend directly on the mental make-up of the patient. The neurotic individual usually is concerned a great deal about these vague sensations for several weeks or months, but it has been our experience that when he is convinced that his paroxysmal pains will not return, he soon forgets about the paresthesia. He has become obsessed with the idea that the relief from his excruciating pain cannot be permanent and interprets these sensations as forerunners of an impending attack.

We have not felt that these complaints of paresthesia occur more commonly in those patients who have not had previous alcoholic injections and therefore have not before experienced this loss of sensation in the trigeminal area. We see them as often in those who have had many injections of alcohol. We cannot subscribe to the making of alcohol injections simply to educate the patient to a loss of sensation.

Several of our patients have complained of soreness in the face, which they have described as being situated deeply in the bone. We have never been able to satisfy ourselves as to the exact nature or origin of this complaint. In all our patients this symptom has eventually disappeared; therefore we are not quite prepared to anesthetize the facial nerve to determine whether this pain originates in a pressure-pain impulse from the muscles of the face and is transmitted by the seventh nerve.

One of the most recent steps in the perfection of surgical technic has been to sever the sensory root and save the motor root of the fifth nerve. The motor root immediately after its exit from the pons lies mediad and somewhat superiorly to the sensory root. It then turns about the medial side of the root and passes beneath the ganglion, coursing somewhat obliquely across the under surface to the medial side of the mandibular division with which it becomes incorporated. The motor root is whiter and more compact than the network of fibers which form the ganglion and merge into the sensory root. It is normally about the size of the lead of a pencil.

The loss of function in the movements of the jaw resulting from paralysis of the masseter and pterygoid muscles, which is due to division of the motor root, is perhaps not sufficient to subject the patient to the considerable lengthening of the operative period necessary to save it. The patient does not suffer any noticeable discomfort in approximation of the jaw, yet there is an asymmetry which can be seen. It is agreed that if the motor root can be saved, one serious objection to the operation will have been removed, particularly in the minds of those who have not been able to observe for themselves the prompt and satisfactory recovery and the complete relief from pain which follows section of the sensory root.

We have been able to preserve the motor root and separate it from the sensory root centrad from the ganglion in an increasing proportion of our cases. Its different texture and pearl grayness help identify it. We have never found it necessary to stimulate it with an electrode, but such a method of identification may be used. Not to belabor the argument further, I may say that we attempt to save the motor in every instance, but do not persist in these attempts to the point of sacrificing good surgical judgment in the matter.

Regardless of whether the motor root is spared, a great many patients complain of losing particles of food between their teeth and cheek on the affected side. In view of the loss of sensation within the mouth, it is easy to understand how this occurs and how it may be quite distressing. The patient easily and rapidly makes a satisfactory adjustment to this situation.

A rather small group of persons complain of a feeling of fullness or heaviness in the auditory canal following the operation. Careful examination of the tympanic membrane and external ear usually offers no explanation for this symptom. Fortunately for both patient and doctor, it soon disappears. Adson has recently suggested that it is caused by the collection of cerebrospinal fluid, which escapes during the operation, within the internal auditory canal.

While not particularly serious in itself, the uncomfortable sensation produced led one patient to introduce a hairpin into the external auditory canal in an attempt to clean it. This led to a marked dermatitis. We have never observed any permanent diminution in hearing as a result of this condition.

CONCLUSION

Emphasis might be placed on several facts: 1. Trigeminal neuralgia is a more common disease than is realized and, as a result, it masquerades for many years under many different and bizarre diagnoses. 2. It is characterized by remissions which should not mislead the patient or his doctor into the belief that their latest method of treatment has been successful in curing the disease. 3. The only known method of affording relief to the patient is division of the sensory root. While alcohol injections may be followed by temporary relief, the pain will eventually

recur. 4. With a reasonable amount of good care, corneal lesions following operation may be avoided. Other annoying symptoms should be recognized and their prophylaxis and treatment emphasized to the patient. Properly cared for, patients with trigeminal neuralgia may be relieved of the excruciating pain and returned to their former social and economic position in life.

PROBLEM OF ESTHETICS IN RESTORATIVE PROCEDURES*

By WILLIAM D. VEHE, D.D.S., Minneapolis, Minn.

ALL restorative procedures in the mouth must conform to principles of biology, mechanics and esthetics to be of the greatest service to the patient.

It is not necessary for us to be reminded that no restoration can be made in the mouth without an appreciation from the clinical standpoint of the future health of the tooth or teeth involved and the surrounding tissues, and an understanding of the technical problem in order to anchor the prosthesis and to build it to function as nearly as possible like the replaced organs, as well as to secure an appearance that defies detection of its artificial nature from a reasonable distance. To those of us with sufficient experience in this work, these statements imply hard, painstaking procedures, with careful observation of details, and, in many cases, even then our results do not come up to expectations and are a source of discouragement.

This paper cannot include a detailed discussion of the clinical side of restorative practice in the mouth or of the technical aspect, but it is asked that we take for granted an understanding of the principles of biology and mechanics in the attempt at a brief discussion of esthetic problems in oral procedures.

"Esthetics" means the science of the beautiful in nature and in art. It has to do with the development of our more delicate appreciations, and is, broadly speaking, a discernment of refinements in our contacts with life. In dentistry, it has to do with the desire to conceal any artificial restoration of lost tooth structure. It becomes evident then that back of all restorative procedures should be the thought that true art conceals art.

The restorative processes in the mouth are naturally of an endless variety, ranging from the simplest replacement of lost tooth substance to a reconstruction of the most complex nature.

The field of restoring individual teeth does not present the difficult problems in esthetics that the more extensive involvements do. These procedures are quite uniformly understood by the profession and accepted as standardized. Operative dentistry covers these procedures thoroughly and little need be said here except to emphasize the inclusion of esthetics in evaluating the case requirements. It is obvious that in such simple restorative procedures as the placement of fillings in the labial or proximal areas of the anterior teeth, porcelain should be the choice. This is particularly true in the

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labial cavities except where the cavity is well away from the gum margin, which would render the use of a silicate safer; or where the filling would not be readily visible, when some other material would not be objectionable.

In the proximal areas, the same reasoning applies. In the boldly exposed areas, the need is more definite for a material such as porcelain or silicate. The shortcomings of the silicates up to this time fit them for a more or less temporary service only, with definite limitations in contact and surface qualities that must be kept in mind. An accurately fitting, well-contoured and polished gold foil filling or inlay in any tooth area that is plainly visible is never beautiful. Porcelain has its limitations where fracture is apt to occur, and that is more likely in small or thin teeth in which the incisal angle is included in the filling. The latter cases can also be treated with a gold silicate combination filling, and while it is true that these fillings are not all that one would like, some very pleasing results and reasonable service are possible. It is necessary to use a very hard gold, and the silicate may have to be renewed at intervals.

The time comes when a tooth crown is involved to the extent that its restoration by filling is impossible. It is here that the use of the porcelain veneer crown comes into its own. This beautiful restorative procedure is so well known and its merits are so well recognized that it would be superfluous to deal with it in detail. It is sufficient to say that this crown can be placed on any tooth in the human mouth and that no other crowning operation can equal it in any respect except, in some cases, in durability because of the friable qualities of porcelain. Clinical practice has taught us the necessity for a preparation providing for a definite and amply wide shoulder and sufficient thickness of the body of the crown to withstand a reasonable application of stresses, thus reducing this otherwise perplexing problem to a sense of reasonable security.

When teeth are lost and we are called on to replace them, our problems multiply. It is here that we encounter difficulties with the appearance of the teeth used as abutments as well as with replacements. Porcelain bridgework has all the qualities to meet the most exacting esthetic requirements; but since its permanence is always a matter of concern, its application must be limited to the more favorable cases. In fixed and removable bridgework, the abutment or anchorage teeth become the primary problem in meeting esthetic desires. It is well recognized that the full gold crown is the most reliable and permanent means of anchorage, but esthetically it is at the bottom of the list of desirables and must be relegated to the unobtrusive areas of the mouth. A metal crown can quite generally be modified by inserting in its face or exposed area a porcelain facing, especially constructed or inlayed; or a pin-facing used for this purpose may, in some cases, quite accurately and gracefully conceal itself. The partial gold veneer crown is much less offensive, but even it cannot always meet the legitimate requirements of an esthetic abutment. Other types of anchorage that may be found desirable in certain types of cases are the especially designed inlays and the so-called pinlays. With the individual requirements for anchorage and extension for prevention in mind, in designing the abutment, one's ingenuity will accomplish much toward a satisfactory appearance even in the most unfavorable cases.

The esthetic problems in replacements or in placing pontics are of a different nature. We have available an elaborate array of teeth and facings that should,

but seldom do, fulfil requirements as they come to us. The changes that are necessary are correction of form or of color, or, in many instances, both. It is seldom that we can use these pieces as we receive them. The change that must be made quite regularly is that of form. This is done by grinding, and polishing or reglazing. Many times, in the correction of form to simulate the individual tooth contour indicated by the case, color distribution is impaired or even destroyed. At other times, this feature is really enhanced. Where the color distribution is destroyed in the reshaping of porcelain pieces, or it is not correct in the first place, the proper changes can be made by the judicious use of stains or by rebuilding with porcelains. Such a correction is possible for all porcelain pieces whether for fixed or for removable bridgework or partial or full dentures, and the technic is the same in all instances.

The esthetic problem in removable bridgework and partial dentures is not so different from that in fixed bridgework. There is the problem of retainers, and, in some instances, this becomes embarrassing. The abutment teeth require a preparation that can be less secure than for fixed work, and in this way a better appearance can the more readily be obtained. In the consideration of retainers, it is quite generally conceded that a properly constructed wrought gold clasp is the most reliable type of attachment. Esthetically, they have nothing to recommend them, and they are nearly always ungraceful and unsightly when placed on any of the six anterior teeth and many times when placed on the biscupids. The intracontour and patented attachments lend themselves to a better appearance, although their delicate construction makes them less reliable.

Full denture cases are often difficult and in some instances it is impossible to defy detection. These patients may be divided into two classes: those not entirely edentulous and therefore with definite landmarks for a more nearly perfect esthetic result, and those entirely edentulous and without any indications regarding the tooth qualities of the case.

In those not entirely edentulous, every means should be employed to make a complete record of the color, form and position of the remaining teeth, as well as the facial contour.

A careful color determination should be made of the anterior teeth, preferably before they are removed. All these teeth should be preserved for the individual form and should be placed in an impression taken of the case before extraction, and then placed in their respective places in the impression after they have been removed and a cast flowed up for a future record of alinement and position.

Photographs of the case for an anterior and a profile view with the mouth opened and also closed with the lips in a natural position are also helpful. A profile guide made of the case by using lead plate or wire and preserved by outlining on a sheet of paper is another help.

These records are most valuable and it is almost criminal negligence not to make them while they may be obtained.

In many cases, the patients who come to us edentulous present the most difficult problem in esthetics. Generally, except as regards physique and face form, together with the arch form and perhaps other landmarks in the mouth, we receive no information that will help us much in our task. It is seldom possible to obtain even a hint about the original appearance of the teeth from the appearance of the dentures that they may then be wearing. Any information that the patient can give should receive careful attention even though it may not be helpful. Previous photographs may give

us some information, and, at other times, it is even possible to obtain some assistance in determining tooth appearance by seeing a sister, brother or even children who are known to have a striking resemblance.

Records should be just as nearly complete as it is possible for us to make them, and when we are ready to make tooth selections, we should choose the teeth very carefully with the object of making the fewest possible changes in both form and color. At this point, we are enabled to see how closely we can meet the needs of the case and how extensive changes in these teeth will have to be.

The reshaping of the selected teeth to simulate the individual tooth form is easily and quickly done by grinding. It merely requires a clear idea of what we wish to do and some true running stones. I mention these stones advisedly as with them there is less danger of chipping delicate margins and the surface so ground is left smoother. It is perhaps best in setting up a full denture to begin with the central incisors in making these changes after we have temporarily positioned them, and then work back from here. In partial dentures and bridgework, the teeth are temporarily set up in the same way, and we proceed with the changes when we see what they must be by beginning with perhaps the most important tooth. These ground areas are then polished by the use of coarse and later finer sandpaper disks, to be finished with pumice on a felt wheel or cone, and lastly with tin oxide or some porcelain polish. In this way a beautiful finish of these areas can be obtained with but little effort, and it is the only way in which to finish a composition pin tooth. A diatoric or platinum pin tooth may be reglazed if that is preferred.

The color of a facing or tooth may be modified or altered in one of two ways; namely, by judicious staining or by rebuilding with our porcelains. Whether staining or rebuilding is indicated depends on what the extent of the color change must be. Generally speaking, when the color or colors of a facing or porcelain tooth must be intensified this can be done by careful staining. When the colors must be changed, the rebuilding of them is the procedure to be desired. When one wishes to color local areas as in imitation of enamel checks or decalcified areas, stains are the most desirable medium for the purpose. To do deep or interior staining, it is desirable to cut into the work, then place the stain in or in some cases mix it into the porcelain when recontouring the work.

A proper technic for staining any porcelain teeth may be briefly outlined, but it is perhaps best first to say something about the metal pins contained in porcelain structures before going into technical detail. The pinless teeth, such as the diatoric, tube, Park pinless, Davis crowns and those having platinum pins, do not cause any concern about the staining temperatures to which they must necessarily be subjected. The denture teeth that have composition pins, whether these are gold covered or plated or not, will hardly permit temperatures above 1550 F. This means that stains must fuse securely on these structures at this temperature. If one desires to use a higher fusing stain on teeth of this type, he should secure them with either platinum pins or without the pins soldered in. He can then attend to staining requirements and, in the latter case, solder the pins in an electric furnace. This is an inconvenience, in that one must have a supply on hand, or must make a special order, with the resultant wait, as they usually cannot be obtained as needed from the supply houses.

If this is not done, the temperatures that are necessary to fuse these higher

fusing stains disintegrate the pins and, in many instances, ruin these teeth. The pins will not become fused during the process of staining, but they become badly oxidized, and when these teeth are sectioned and put under a low power, one can plainly see the destruction of the anchorage metal which had been fused into the tooth originally. Fluxing the pins or investing them does not alter this effect.

The surfaces to be stained should be smooth, not porous, and clean. If porosity exists as after grinding, this area should be covered with a suitable porcelain or glaze beforehand. The work should now be ready for the application of stains. It is important that we be careful in the color selection and mixing of stains for the best results. They should be applied sparingly as there is that constant tendency to get them too intense. Of course, if this occurs, one can reduce the color by disking it down carefully to the desired intensity and then fuse to complete it. In many instances, it is desirable to cover the stained area with a suitable porcelain or a glaze since this gives it the effect of depth. If this is to be done, it had best be applied after the stain is fused so that one sees the results of the staining and can still make alterations easily.

Staining porcelain structures is an art requiring some experience for good results. It is but logical that the stains should be placed on porcelain structures where they occur in the natural teeth. If one is not sure of results beforehand, he can run through a technic piece, which will enable him to perfect his procedure.

In endeavoring to correct the color of porcelain pieces, the best results are obtained by rebuilding. This is particularly true when the color must be changed. Such a procedure enables one not only to correct the color requirements, but also to work in individual tooth form at the same time. This correction is not so difficult as in many instances it is to stain the work effectively. A careful color discrimination is required to obtain an accurate color result, just as for building a veneer crown or an inlay. The procedure is to cut out the areas of color that are to be changed and then to reconstruct with the selected colors of porcelains, overbuilding to allow for contraction and a more accurate contouring after the work has been biscuited. Before the piece is placed back in the furnace for the final fusing, it is carefully cleaned, and more porcelain is added wherever necessary if that is required. In rebuilding porcelain facings, the piece is ground down to a thin layer, which is to serve as a foundation upon which to rebuild. The facing to be rebuilt is selected for size, and its color should be accurate enough not to influence unfavorably the results which we are striving for. In full denture procedures, one should keep in mind the difference in the color of the teeth in the same arch. The older the patient is, the more liberties we are permitted in this respect. In partial denture and bridgework procedures, the individual tooth color problem takes care of itself very largely when the color determinations are made.

In the final setting up of the teeth in replacement procedures, position means much toward a pleasing appearance. The cuspid is perhaps the most difficult tooth to place in a natural position. It is many times desirable to space some of the teeth where that can be done, but one must generally be careful not to have these too large. It is seldom a good procedure to set the teeth up in a regular manner. A mechanically measured exactness does not fit in with Nature's best efforts.

"Esthetics" is an indefinite term and probably does not mean the same thing to each of us. It should mean a desire to

conceal what we are called on to do in the mouth. Our patients are very appreciative of our efforts as regards their appearance. In fact, they more and more seek out the man who is capable and is known to emphasize such service. It is our duty to include esthetics as one of the fundamentals in evaluating a case, and it should be a pleasure to us to lend our efforts to concealment of all restorative processes in the mouth.

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A CENTURY OF PROGRESS IN PARTIAL DENTURES, CROWN AND BRIDGE AND CERAMICS*

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IT is a rare individual who can discern the truth of present day progress. If such individuals exist, their revelations cannot be judged by contemporary critics. Only those of another generation are competent to sit in judgment. In the case of dentistry, the public itself will be both judge and jury in the final analysis of the success or advancement of the profession over a period of years. We within the profession must calculate the scientific and technical causes of our success and advancement. If we fail to estimate properly the reasons for our failures, there will be no advancement.

There is a wide diversity of opinion in all branches of human endeavor except within the exact sciences. Individuals within the profession may widely disagree in regard to the respective merits of the Black cavity preparation and the slice inlay technic. We cannot offer definite proof of mathematical exactness of the superiority of either. It has been stated by authorities that the theory of focal infection has never been proved. Yet who among us who has spent any time in the practice of dentistry can say or believe that it is not a fact? Is not our present day dentistry based on this belief? Yet out of all this divergence of opinion and confusion of statements recorded by members of the profession, as well as critics of our work, have come certain definite facts, also theories backed by such overwhelming evidence that we are safe in recording certain steps and changes as advancement, with the assumption that the majority of the members of the profession will agree.

It is often said that there is nothing new under the sun. Advancement is generally the evolution of practice rather than a radical change caused by new discoveries. After all, there have been men within the profession who deserve credit for their work and efforts to advance that phase of dentistry which we are discussing in this section. It is my intention to give credit to a few of them. It will be impossible to give credit to all of that vast array of workers who have made possible the advancements in ceramics, partial dentures, crowns and bridgework.

It is interesting to note, in what meager records we have of ancient dentistry, that restorative work has a prominent place. Therapeutic treatment evolved from sacredotal medicine, owing to the desire of the priests to benefit their pa-

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tients, while, it seems, restorative work was introduced by the Egyptians, the Greeks and the Etruscans as the result of a direct need to replace lost teeth.

What we are particularly interested in today is the progress of restorative work during the past hundred years.

It would be interesting if it were possible to turn back the pages of time one hundred years to a day and visit some of the dentists who were practicing in August, 1833. Just what treatment did the laity of that day and age expect? It is evident from the writings of Mills and others that the practice of dentistry was unrestricted in 1833. It is also evident that the members of the profession during that period were not modest, nor did they consider advertising unethical. The literature records advertisements published during the early part of the nineteenth century, and therein we learn at least what the dentist of that day claimed to do. We do know that some of these men carried on successful practices, and thereby laid the foundation for modern practice as we know it today. In reviewing some of these advertisements, it is interesting to note that the dentists of 1833 made repeated claims to restore lost teeth with permanency and so natural in appearance as to escape detection.

The dentist of 1933 does not hesitate to show his disgust when his supply house cannot furnish him with facings or denture teeth of the exact mold and shade that he desires. A few hours spent in the study of dental history, and more especially the genesis and evolution of ceramics in dentistry, would convince him that he should be more appreciative of the conveniences offered by the modern manufacturer and supply depot.

Development of ceramics in dentistry, of course, has had its most rapid development during the past century. To best understand the status of porcelain in 1833, it is perhaps best to review its earlier history. It is little wonder that early workers in restorative dentistry looked on mineral teeth as a substitute for natural ones. Their possibilities must have been intriguing.

It has been reported that Jacques Guillemeau, of France, mentioned the manufacturer of porcelain in 1594. Others state that, in 1728, Fouchard, a French dentist, proposed the use of porcelain. The chemist Duchateau, with the cooperation of the dentist Dubois de Chemant, did some work with mineral teeth during the latter part of the eighteenth century.

Others of this period who were credited with improvements in mineral teeth were Dubois Foucon and Fonzi. In 1817, it is recorded that Dr. A. Planton, who came from Paris, arrived in Philadelphia bringing a supply of porcelain teeth with him. It seems that the French dentists of the eighteenth century were undoubtedly the forerunners and instigators of modern ceramics, but it remained for American dentists and manufacturers to improve and perfect porcelain teeth.

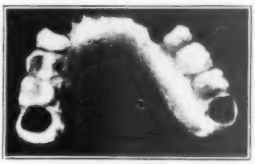

Fig. 1.—Upper partial, eighteenth century (Guerini).

Fig. 2.—Dwinelle crown (Prothero).

Progress in the use of porcelain in dentistry was not rapid during the first fifty years of the past century. We would show little gratitude if we as a profession did not give the manufacturers the credit that they deserve in the advancement of ceramics in dentistry. To get a proper perspective of their work, we must refer to Samuel Stockton White. History records that he was born June 19, 1822, at Hulmeville, Pa. At the age of 16 years, he was indentured to his uncle, Samuel W. Stockton, of Philadelphia, who was at that time engaged in the manufacture of porcelain teeth. While working with his uncle, he studied dentistry under J. DeHaven White, not a relative, but a leading practitioner of the time. He began the practice of dentistry at the age

Fig. 3.—Porcelain crowns with wood dowels (Prothero).

of 21 years, at the same time superintending the manufacturing of teeth in his uncle's plant. In the year 1844, he began the tooth manufacturing business for himself, founding the firm that has been active through the years in the development of dental porcelains. In 1844, workers in porcelain depended on furnaces that used coal, coke, gas or oil for fuel. As the furnaces were of a crude type, we can well appreciate the untiring efforts and the enthusiasm necessary for porcelain workers to get results. Long hours and hard work must have been the rule of John Allen, of Cincinnati, Ohio, who is given credit for being the first man to successfully produce continuous gum dentures where other men failed. Dr. Allen constructed his first denture in 1844 and completed his experiments in 1851.

It is difficult to state just when porcelain was first used as a material for inlays. In 1837, Murphy, of London, conformed a platinum matrix to the prepared cavity, and, in this matrix, a glass inlay was fused, being held in place with amalgam.

In 1857, A. J. Volick recommended the use of porcelain for filling cavities in the front teeth. The inlays so formed were held in place by packing ropes of gold foil around their peripheries.

In 1862, B. Wood shaped porcelain blocks to tooth cavities by grinding to form.

In the use and development of the porcelain inlay and the porcelain jacket crown, the name of Charles H. Land

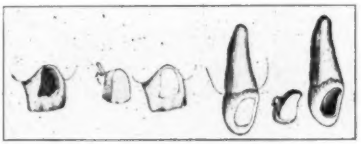

Fig. 4.—Dr. Wood's porcelain inlays (Prothero).

stands out in bold relief. He is given credit for suggesting and developing the metal matrix gold or platinum. This led to the development of the porcelain inlay, which was first made by the direct method, burnishing the matrix into the cavity preparation in the tooth itself. In 1889, Dr. Land received a patent on what he called the "Land jacket crown."

From the day of Dr. Land, the development of the jacket crown and the porcelain inlay has been rapid. Thanks to such men as Capon, Legro, Argue, Vehee, Hovestead and Felcher, development goes on. There is yet much to be done to perfect and develop the porcelain inlay. The use of a combination silicate cement has been of great value in cementing porcelain inlays and eliminating the shadow

caused by the oxyphosphate cements.

In reviewing the literature since the day that Land suggested the use of the platinum matrix, we find the profession growing hot and cold over porcelain inlays. At the height of their popularity, they were asserted by some operators to be the last word in a filling material, and in their enthusiasm, dentists employed them in all types of cavities. As the years rolled by, these inlays have fallen from grace, and we find periods in which the baked porcelain inlay had few advocates, and the current of popular thought was against them. No doubt, the introduction of silicate cements had a great deal to do with their loss of popular favor. The advent of the gold inlay did not help their cause, and, between them, the two almost forced this useful and esthetic type of restoration out of the picture of dental progress. Within the past few years, some operators have become discouraged with results obtained by the silicate cements, and as there has also been an increased demand for esthetics in dentistry, there has, as a result, been a revival in the use of porcelain inlays.

Fig. 5.—Webb modification of Bing bridge (Prothero).

Fig. 6.—Litch's modification of Bing bridge (Prothero).

Early workers in porcelain had nothing to work with except the old coke furnace. C. H. Land produced the first gas furnace, in 1886. In the early nineties, we still find Dr. Land and others discussing the effects of gassing on porcelain. In 1894, L. E. Custer invented the first electric furnace. The first model was rather crude, but it was a forerunner of others that were to bring about a great improvement in methods of firing dental porcelain. Other electric furnaces to follow were the Hammond, the Pelton, the Peck, the Gerhardt, the Roach, the S. S. White, the Barkmeyer and others. Weston A. Price of Cleveland was the first to apply the pyrometer.

Thanks to the efforts of the above mentioned workers, we can now buy excellent porcelain furnaces. The progress and development of the porcelain furnace has been an important factor in the advancement of ceramics in dentistry.

Dr. Capon reports that, in 1838, Dr. Wildman succeeded in producing mineral teeth that were transparent and granular in appearance, with a flesh-like tint to the gums and unlimited shades and esthetic effects.

The development of porcelain powders is hard to trace. No doubt the manufacturers had a great deal to do with it. W. S. Jenkins, of Dresden, presented low fusing porcelain materials to the profession in 1898. In the production of colors and shades, we can again thank the manufacturer for our present-day conveniences. No discussion of porcelain teeth would be complete without mention of the name of James Leon Williams. He gave us a definite classification of face forms, and was instrumental in developing types and shades. His classification of outline forms practically made obsolete the temperamental theory. Dr. Williams succeeded in persuading the Dentists'

Supply Company to produce these tooth forms and shades. Another step forward was taken in the manufacture of porcelain teeth for dentures and facings for bridgework.

It would be too complicated a task to give the different manufacturers the credit that is due them for their share in the progress of ceramics in dentistry. As heretofore stated, we as a profession should be grateful for the improvements that have been made in stains, porcelain powders, colors, types and shades in both denture teeth and porcelain teeth for bridge restoration.

Types of removable work prior to 1833 were of questionable value. If we go back to that age of the Etruscans, the Romans and the Egyptians, it is difficult

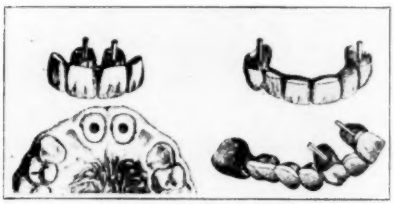

Fig. 7.—Williams' bridges, 1884 (Prothero).

to determine whether they intended their prosthetic appliances to be fixed or removable. No doubt most of them were removable. History does not give us a great deal of valuable information regarding partial dentures. We are particularly interested in the progress made since 1833 or during the past century.

As vulcanite was not made available for denture work until 1855, in 1833 base materials were restricted to metal or porcelain. Stockton began the manufacture of porcelain teeth in 1825. James Gardette, in the latter part of the eighteenth century, is given credit for using clasps to retain dentures. He came to America from France in 1778. Piecing what meager information we have together, we should surmise that, in 1833, it would be possible for the laymen to obtain a partial denture with a metal base and porcelain teeth, and retained with clasps. In the first volume of *Dental Cosmos,* page 407, we find a cut and a description of a partial denture swallowed by a patient in 1859. The person was fortunate in not having any serious results from this accident, and the partial denture was recovered after a period of five days. To us the interesting phase of this incident is that the case was reported and we have a picture and description of the plate. The report in the *Cosmos* also states that the partial was made in 1849.

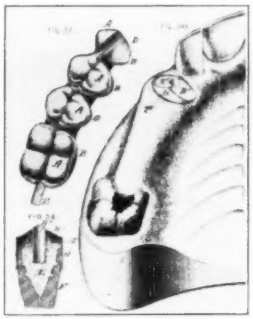

Fig. 8.—Williams' bridge, 1886 (patent office).

The description reads as follows: "They were on a gold plate, quite heavy. Made eleven years ago. Replaced three anteriors. Held in place by clasps." This gives a good idea of partial denture construction and the type in use 100 years ago. In 1855, Charles Goodyear patented a process for making dental plates using vulcanite as a base. This no doubt was a great aid in the construction of partial dentures. Cheoplastic metal was introduced in 1856 by Blandy, of London. This method consisted in casting the base of a low-fusing alloy and attaching the

teeth at the same time. This method was soon displaced by the use of vulcanite.

Smith Hyatt patented a process for manufacturing celluloid in 1869. This material was used a great deal for some time in full dentures, but how extensive its use became in partial dentures it is difficult to say.

The dental profession fought the Goodyear Company for many years before they were to enjoy the use of the valuable material vulcanite in the practice of dentistry.

Some idea of the progress and development of partial denture construction up to 1887 can be had by reading the "American System of Dentistry," edited by Litch, in 1887. William Freeman gives an extensive description of the mak-

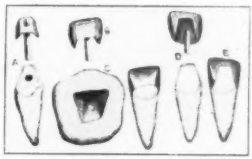

Fig. 9.—Alexander inlay methods (Prothero).

ing of partial dentures on bases of gold and silver.

In 1907, the casting technic was introduced. Oct. 3, 1910, William Hunter, of London, delivered his famous address "The Rôle of Sepsis and Antisepsis in Medicine," at the opening sessions of the Faculty of Medicine of McGill University, Montreal, Canada, which was printed in the London Lancet in January, 1911. A few years later, use of the roentgen rays became general. All of these events will be given more than passing comment later. I mention them now as they were events that led up to the controversy over movable and removable bridgework.

Dr. Hunter had pointed out the unsatisfactory effects of the type of fixed bridgework in common use in 1910, developed mostly by American dentists. The theory of focal infection called attention to the systemic effects of devitalization of the teeth. The roentgenogram disclosed infection in the supporting tissues of pulpless teeth and that caused by poorly constructed types of fixed bridgework. The dental profession became convinced that this trouble must be corrected or dentistry could not hold up its head and maintain its status as a health service. One of the first methods arrived at for correcting the faults of fixed work was to eliminate that type of restoration. Con-

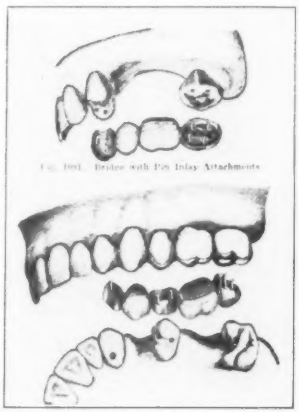

Fig. 10.—Alexander's pin inlay attachments (Prothero).

sequently, we find the ten-year period from 1915 to 1925 devoted to removable bridgework, and dental literature filled with arguments and discussions regarding the relative merits of fixed and removable work. As a great many advocates of fixed work were not willing to give up this valuable type of restoration, we will note not only a development of the removable type of work, but also a complete evolution of the fixed work, from the condemned appliance into a new type

of hygienic restoration that had both functional and esthetic qualities.

During this period, we find at times that there is more or less confusion, and it is difficult to differentiate between the partial denture and the removable bridge. Norman B. Nesbett, of Belmont, Mass., was one of the first men to become interested in the removable bridge. He read perhaps what was the first paper ever published on cast clasp bridgework: "The Cast Clasp in Removable Bridgework," read before the Massachusetts Dental Society at Boston, at the annual meeting, May 5, 1916.

Since Dr Nesbett's paper was presented in 1916, many types of cast clasps and cast work for both the partial denture and the removable bridge have been pre-

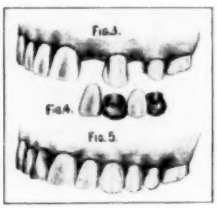

Fig. 11.—Carmichael attachments.

sented. In order that we may have a better understanding in regard to the differences between a partial denture and a removable bridge, I shall refer to the removable bridge as a restoration that might be substituted by fixed bridgework.

Some members of the profession objected to Nesbett's type of clasp, stating that it covered too much of the tooth surface and that the teeth decayed underneath the clasps when not properly cared for by the patient. In 1924 at the meeting of the American Dental Association in Dallas, Texas, Polk E. Akers, of Chicago, read a paper on the one-piece castings for partial dentures and removable bridges. Dr. Akers' type of clasp, which had very little bearing surface on the supporting tooth, overcame the criticism of decay underneath the clasp. The one-piece casting did provoke a great deal of discussion, for the simple reason that, in 1924, shrinkage of gold was not compensated for. Since that date, this difficulty has been overcome.

The next development of cast clasp construction came from F. Ewing Roach, of Chicago, who developed a clasp that had still less bearing on the tooth structure. The Akers clasp was narrow and covered little of the tooth surface. The Roach clasp came in contact with the tooth only at the end of the clasp itself and caused still less injury to the tooth.

The different types of partial dentures developed during the last fifteen years are too numerous to mention. The broken stress partial where spring wires form the attachment between the bar and clasps and the base itself has a great deal of merit. In 1933, we have a variety of types of good clasp dentures to choose from.

The use of an elastic impression material has lightened the load of many an operator in the field of partial denture construction, making it possible for us to obtain detail and reproduction of contour and undercuts impossible with compound and difficult with plaster.

The development of impression materials, base materials, and materials for casts has shown marked progress during the past quarter of a century. Our work has been made a great deal easier and far more accurate.

A discussion of the progress and advancement of partial dentures and removable work would not be complete without the mention of attachment types. Where the crown, inlay or three-quarter crown and the attachment is fixed on the tooth or root, a corresponding attachment is fixed on the restoration, and the den-

ture or bridge is thus stabilized by mechanical means.

Among the common types that have been used are the Roach ball and tube, the Morgan attachment, the Gilmore attachment, the tube attachment and the glove button type on devitalized roots. Another type is the attachment made within the inlay or crown, such as the Chayes attachment. Many of these types of attachments have been used with success and have given years of satisfaction.

It is needless to say that the patient today in need of a partial denture or a removable bridge can get a high type of service and an appliance that can be used with comfort and success, quite different from the crude types in use 100 years ago.

In Guerini's "History of Dentistry," we find cuts and descriptions of attempts at dental restoration which indicate that bridgework was practiced to some extent by the Etruscans, the Romans and others, but it seems that the art was either neglected or forgotten down through the years and little advancement was made. In the beginning of the nineteenth century, there was apparently little attempt to restore teeth by what we now term crowns and bridgework.

De Chamant mentioned pivot teeth of porcelain in 1802. Grooved flatback facings were used in this country and in Europe a few years later. In 1840, the Ash tube tooth was introduced and used to a limited extent in crown construction. In the fifties, full contoured porcelain crowns with wood pivots were introduced. The pivot was forced to place, while moisture caused the wood to swell and held the crown firmly in place—not so desirable from a hygienic standpoint. In the forties, we find mention of the Smith crown and the Clark crown. Prothero gives the following description of the Clark crown:

> In 1849, Dr. F. H. Clark devised a removable crown, which was attached to the root by means of a metal dowel, split to form a spring, for bearing against a metal tube firmly fixed in the root canal. It was so formed as to afford drainage for pus or vent for gas which might accumulate in the pulp chamber.

W. H. Dwinelle described in 1855 in the *American Journal of Dental Science,* a crown in which he used both gold and porcelain. This crown was constructed for both vital and pulpless teeth.

In 1869, G. V. Black described a crown which was very similar to the crown patented by Dr. Richmond in 1880. During this period, many types of crowns were described and patented. M. L. Logan introduced the Logan crown in 1885.

Bridgework of a practical type seems to have had its origin in the year 1869. In the October issues of the *Dental Cosmos* of that year, Dr. Bennett described a method of restoring a single missing tooth as suggested by B. J. Bing of Paris. A facing was soldered to a bar, cavities were prepared in approximating teeth and the bridge was held in place by the packing of gold foil into the cavities and around the bar ends.

In 1880, Wilbur F. Litch suggested a modification of the Bing bridge which seems to resemble to a great extent the modern pin inlay bridge. In his wing plate bridge, the backing was extended beyond the dummy to rest upon the lingual surfaces of the proximating teeth. Perforations were then made in the wings and corresponding holes drilled in the teeth, through the enamel and as deeply in the dentin as practicable, without endangering the pulp. Headed platinum pins were passed through the plate into the holes, the relation between backing and pins was secured, the case was invested and the pins were soldered to the wings. The substitute was set with cement.

We should not fail to mention the two-piece gold shell crown described by W. M. Morrison in the May number of the *Missouri Dental Journal* in 1869.

In 1884, J. Leon Williams suggested in the *Dental Cosmos* the use of a modified Richmond crown as an abutment for bridgework. In 1885, he described and showed illustrations of bridges in which the modified Richmond and the shell crown are used as bridge abutments. This type of bridgework with porcelain facings was to be the common type for many years.

It would be impossible to mention all of the types of crowns and bridgework developed during the next few years, but I should fail in an attempt to record progress if I did not mention C. L. Alexander's work with pin inlays. In 1896, he described his method of making these inlays, which were used as bridge abutments. Thus, we have the forerunner of the modern pin inlay bridge.

Oct. 9, 1900, the United States patent office issued to John Peter Carmichael of Milwaukee, Wis., a patent for the process of an attachment for building up broken or decayed teeth. There is nothing so strange about the matter of obtaining a patent, as it was common practice among members of the profession of that time. The important thing to the dental profession is that this attachment developed into what we now know as the Carmichael, or three-quarter crown, one of the most common types of bridge abutments in use on vital teeth today. Dr. Carmichael should be given due credit for the suggestion and development of one of the finest types of abutment attachments that we have in use today.

The years from 1869 until the introduction of the casting process by Taggart were prolific ones from a mechanical standpoint. A great many patents were obtained by members of the profession, especially in crowns and bridgework.

There is one result that issuance of patents brought about: It created a great deal of controversy and in many instances ended in the courts. These court records have given us some interesting data and a great deal of detail that otherwise would be difficult to obtain. It has been my good fortune to study the copies of the court records, both the complainants and the defendants record, in the case of John P. Carmichael vs. Harvey N. Jackson in a suit pertaining to the use of the Carmichael crown. The defendant introduced as evidence the work of Williams, Land, Low, Waters, Wells, Wiggins and others, as work done prior to Dr. Carmichael's patent on the three-quarter crown.

A particular bit of interesting evidence is that regarding Allan G. Bennett. In the *Dental Cosmos,* Volume 30, is recorded a discussion held at the regular meeting of the Odontological Society of Pennsylvania Feb. 4, 1888. During this discussion, Dr. Bennett is reported as saying "I have a model here which I will pass around for the inspection of the members. It is a new attachment or anchorage for bridgework. It consists of a vertical half-cap, which incloses the inner part of molars and bicuspids, and is retained in grooves on the approximal surfaces and between the cusps. Dr. Allan Bennett was called as one of the witnesses for the defense during this case, April, 1908, and produced the above mentioned model and testified that he had used this type of attachment in the construction of bridgework both at the Pennsylvania College of Dentistry, where he was chief of the clinic from 1883 to 1888, and that he had used it extensively during his years of practice later in Minneapolis, Minnesota." Just how closely the work of Bennett and

others introduced by the defendant resembled the Carmichael crown matters little to us today. Again, we say, there is little new under the sun; but the thing that we members of the profession should be grateful for today is the fact that these men, working through the years, have made possible the modern type of work.

Let me again quote from the complainant's record, and give Dr. Carmichael's own description of his three-quarter crown:

> My invention relates to an improvement in the process of forming an attachment for and connecting the same to natural teeth. The inside portion of the crown of a natural tooth is properly shaped by cutting two parallel grooves on the lateral side edges and a groove across the bottom end or occluding surface. The contour on this surface is of the thickness of the attachment to be made. A base is then fitted to the portion of the tooth, thus prepared, and into the groove, that it may be mechanically maintained in position upon the tooth. This base, which is usually made of thin sheet gold, must be fitted to the tooth thus prepared and carefully removed, without bending, springing or in any wise changing the form. It is then strengthened and stiffened by adding more metal without distortion, warping or changing of form. It is then cemented in position upon the natural tooth.

Again, in the defendant's record, are the cut and the description of an artificial tooth crown patented April 14, 1896, by J. B. Wells of Lowville, New York. The crown has all the earmarks of being the progenitor of the full-cast crown in common use today. Dr. Wells made his crown by constructing a platinum matrix that fitted over the tooth preparation and then soldering pure gold over the surface of the matrix.

Jan. 15, 1907, is a memorable date in recording the progress of dentistry. On that date, before the New York Odontological Society, Dr. Taggart read his paper on the casting process. Before that time, Prothero reports: "Beginning about 1889, and for a number of years following, Dr. G. M. Martin of Indiana demonstrated and taught the method of casting inlays, crowns and bridges in the Indiana Dental College, and in postgraduate work in Indianapolis." Many other casting technics were reported prior to 1907.

The fact remains that regardless of controversies or of court decisions, Dr. Taggart gave us a technic that was little improved on until the development of the expansion technic in recent years. The dental profession owes him a debt of gratitude that can never be paid in full.

Before we leave the subject, I should like to mention the work of Meyers, Price and Van Horn, who were working on wax expansion as early as 1910. This work seems to have been overlooked by the profession at large until, in later years, the development of the full cast crown made it imperative that some type of expansion technic be developed.

Just who should be given credit it is difficult to say. No doubt, it was the work of many rather than a few. In May, 1927, it was my pleasure to witness a clinic presented by Herman A. Maves on the work of Frederick S. Meyer, of Minneapolis, on wax expansion technic. This work seems to have stimulated work by others all over the country. The Bureau of Standards, at Washington, D. C., took up the investigation and did a great deal of research work. Some of its early work in both wax expansion and mold expansion is reported in research paper No. 32, issued in December, 1928. Mold expansion has been worked out satisfactorily during the last few years and seems to be more popular with the profession, as it is a much simpler technic than wax expansion. Today, there are a number of manufacturers offering mold expansion investments that give splendid practical results. Among the first to be offered was the

green investment of the Ransom & Randolph Co., and the investment of the Whip Mix Corporation. The Kerr Manufacturing Company have recently offered cristabolite, of which much has been written.

Hunter's paper heretofore mentioned is familiar to all members of the A.D.A. for its far-reaching effect on dentistry, especially restorative work.

The roentgen rays, discovered in 1895 by William Konrad Roentgen, were coming into general and practical use during the period 1910-1915. About 1916-1917, it began to dawn on the profession that all was not well with the fixed bridges then in general use. It had become common practice to devitalize all teeth used as bridge abutments. The common type of abutment was the Richmond crown and the shell crown. Among a majority of the members of the profession, it was considered poor practice to use a vital tooth for an abutment. The type of pontic used was not one that could be easily cleaned, and it was literally true that a great many of our fixed bridges, as well as individual crowns, not only were unclean but also were causing local and systemic infection. Hence, the period of controversy over the fixed and the removable bridge.

Hunter was right. His indictment, along with the roentgen rays and the theory of focal infection, awoke the profession, and the year 1916 saw the beginning of a new and different type of crowns and bridgework, and the use of vital teeth for abutments. Happily, we had the casting process and the work of Carmichael, Alexandra and others—a foundation for the work to come.

In the development of the new type of work, we find the name of Edward T. Tinker prominent during this period. We find him a busy man in this field, developing and instructing. The profession indeed owes him a debt of gratitude for his untiring energy and his helpful work at this time.

Dr. Tinker developed the porcelain tip pontic about the year 1915. He introduced the hard gold formulas in 1907 and 1908. He also gave a clinic on the cast full-gold jacket crown before the Minnesota State Dental Society, in 1909.

Billings is given credit for introducing the theory of focal infection, in 1914. This theory was not entirely new, and no doubt proof could be obtained that it had been suggested many years earlier, but that is beside the point. The fact is that a combination of events—Taggart's perfection of the casting technic, Hunter's paper, the development and general use of the roentgen rays and the theory of focal infection had a profound effect on the practice of restorative dentistry. Beginning with 1914, we find the dental profession almost as one mind turning to the elimination of infected areas. The roentgen rays disclosed many hidden pockets and apical infection. No doubt, as some have said, it was carried to extremes, and, as one prominent member said, the profession was literally seeing red. They wanted blood and got it by extracting teeth. One hundred per cent clubs were formed and there were other evidences of a radical reaction. Regardless of mistakes made, it is my belief that time will justify events and that future judges will decide that, during this period, dentistry took its most advanced step forward. Previous to this time, function and esthetics had been the main objective. During this period, the dental profession really became one of a health service, and a profession whose main object was the elimination of oral and systemic infection.

From 1914 on, we find that restorative dentistry developed the three following considerations, named in the order of

their importance: (1) the health of the tissues of the oral cavity and the general health of the patient; (2) the function of the teeth as a masticating unit, and (3) esthetics.

When the findings of the roentgenogram proved conclusively to operators that it was necessary to use vital teeth for bridge abutments wherever possible, members of the profession began looking about for attachments to take the place of the Richmond and shell crowns. Inlays of the mesioclusal and mesioclusodistal type at first seemed to solve the problem and, for a time, inlay bridges were a common type of fixed restoration. A great many of them failed owing to lack of stability. As we have previously pointed out, the way had already been paved for the use of the pin inlays, the three-quarter crown and the full-cast crown. The perfection of the casting process has made possible many types of attachments for vital teeth. We have advocates of the slice preparation and of this type and that type. The fact remains that the general trend has been to an attachment that grasps the tooth rather than to one that is held within the tooth itself. No doubt, the fundamental principles as offered by Dr. Tinker are the most common in use for the three-quarter crown. It is interesting to note that, in our museum at Baylor University, we have a three-quarter crown constructed by Dr. Radcliff, of Fort Worth, Texas, in about the year 1900. It was for a vital cuspid tooth, made with a platinum matrix by the Carmichael technic, and carried a bridge until 1925. The principles of preparation of the crown are almost identical with the preparations of the modern Tinker crown. The full cast crown is superseding the banded crown. A great many operators gave up the band nine or ten years ago.

The porcelain tipped pontic has given us a clean and hygienic pontic to replace the more or less unclean gold one of twenty years ago. We have advanced, but it would be an idle boast to state that advancement has been due entirely to modern dentists.

Before the end of the nineteenth century, we find operators doing excellent work in ceramics. The porcelain inlay and the jacket crown were well developed. Fine inlays were constructed by the matrix-solder method. The three-quarter crown had been used for bridge abutments. The pin-inlay bridge had been used on vital teeth. A fine type of a partial denture was being constructed. Articles had been written on "The Human Mouth as a Focus of Infection."

Justice would not be done to progress in restorative dentistry if we failed to mention the development in reconstruction work and the study of occlusion that has gone on during the past few years. The Monson group, with their spherical theory, have not only done a great deal of work themselves, but have also stimulated others. At Buffalo, in 1932, Frederick S. Meyer gave an interesting clinic on functional occlusion. In reconstruction work, we might mention such names as Bird, Tinker, Bailey and McLean. It is impossible to give credit to all who deserve it. We can only say the good work goes on.

It has been truly a century of progress and indeed credit should be given to the many rather than the few. While it is perhaps true that our full development to a health service has occurred within the past twenty years, the path was hewn by the toil and energy of those who have gone on before—men who have been creators as well as workers—the Whites, the Blacks and the Lands, who have come and gone in an endless procession during a century of progress.

ROLE OF BIOMETRY IN ORTHODONTIC RESEARCH*

By WILTON MARION KROGMAN, Ph.D., Cleveland, Ohio

THE interest of the orthodontist in the application of biometric methods to orthodontia is comparatively recent. But we, as practical orthodontists and as men interested in orthodontic research, are not even journeymen statisticians. We are more nearly apprentices, who must spend our years of apprenticeship learning the merest rudiments of the craft. Therefore I, as a journeyman, come before you to discuss a few basic "tricks of the trade."

If I were to attempt a one-word analysis of the purpose of orthodontic research, I should state that orthodontia aims at: symmetry. I should have to extend my definition, of course, and then I should add that the symmetry must be functional and it must be esthetic—to "work right" and to "look right." Immediately, the problem of the creation of a standard of "rightness" presents itself. Is this standard determined by the majority? Can it be applied to specific cases, and, if so, how are we to judge the presence or absence of this standard in individual instances? The problem resolves itself, I think, into a question of the normal versus the abnormal—the "right" versus the "not right."

Now, I do not pretend to know exactly what the normal is, yet the term is used whenever one wishes to imply the idea of rightness, of harmony, of symmetry. The normal is, I think, the mental summation of the frequency of observed conditions: it becomes, in a sense, the usual. By a similar process, deviation from the usual becomes the abnormal.

The content of the concept of the normal may be approached from several directions. The early statements of the Angle school were concerned with the esthetic results: "The study of orthodontia is indissolubly connected with art as related to the human face." One of its main purposes was the restoration of harmony, to give a relative symmetry, for the patient himself regarded the anomaly as basically a distortion of facial expression, disregarding the accompanying disturbances in function. A result of this idea of the normal was the establishment of types of facial contour, chosen for symmetry; then, the ultimate, the establishment of a concept of rightness for the individual—the "individual normal," each case to be treated as unique, with correction harmonizing with individual contour.

This leads us to another interpretation of the normal: the etiologic, which Simon defines as "a search for, or determination of, the difference between the existing denture of a patient and the condition to be established." Here, we have both the normal, the end-result; and the abnormal, the existing condition. The etiologic basis may have two widely differing applications: either the anomalous

*From the Anatomical Laboratory, Western Reserve University.

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condition is a departure from an average, which will constitute the condition to be established, or it will merely be the difference between what is and what ought to be for the specific individual. In other words, here again we see a conflict between group and individual; more than that, the etiologic point of view, by definition, leads one into the maze of cause and effect.

A third interpretation of the normal is from the anatomic point of view: that the denture is normal when its component parts are in correct anatomic apposition. This implies a correct harmony of their mesiodistal and buccolingual relations. The criterion of the normal here is *correctness,* more or less predetermined by the structural peculiarities of the two dental arches. If they are not correct, they are abnormal; i.e., there must be a basic disturbance of the structure for either or both arches to deviate from the normal.

Since anatomic relationships are closely linked with function, we turn now to the functional interpretation of the normal. Put in its crudest form, it implies that the normal means "working right." The White House Conference on "Growth and Development of the Child" summarizes the functional point of view as follows:

> Normal . . . does not mean simply the usual or the average, and neither does it mean the best, although it ordinarily carries a connotation of all of these ideas. The most important meaning which we wish to attach to it is the ***absence*** of ill health or incapacity. If we find that a child shows indications of an incipient disease which does not yet cause outspoken symptoms, the child cannot be described as normal until the disease has been cured. This use of the term focuses attention upon *practical considerations of functional performance.* At the same time, it is impossible to avoid entirely the use of the term normal when we mean average, typical, or standard.

In this light, the normal becomes a veritable goal—not necessarily conformity to the average or to a standard, but the realizing of potentialities. Inherent in this point of view is a recognition that the endowment of the individual, both his heredity and his environment, may be a little more or a little less than the average. This natural expected variability is associated with a central tendency, deviation from which is a measure of the degree of abnormality.

With this, we come to a biometric interpretation of the normal: an average based on statistical reduction; an average predictable for the whole by a measurement of a part; an average defining the limits of expected variation, the extremes of which, in orthodontia, constitute those instances demanding corrective treatment.

The application of biometric methods to orthodontic research is the result of the natural sequence of events. The face has long interested both the anthropologist and the dentist, the former from the racial standpoint, the latter from the dental—both interested in prognathism. Camper, in 1791, and after him Blumenbach, Retzius, Virchow, Welcker, von Ihring and Topinard, studied prognathism craniometrically in an effort to classify races by facial types. Carabelli, in 1845, and after him Iszlai, Sternfeld, Schröder, Van Loon, Oppenheim, Korkhaus, Simon and Hellman, studied prognathism as reflected in the reciprocal relationships of the upper and lower dental arches. These two approaches are united in the facial growth studies of Todd, Hellman, Broadbent and Brody and my own, and with them comes the biometric approach to orthodontic research, energetically championed by Tildesley and Young of the Biometric School of London.

Biometry enters in because of the impossibility of studying the entire popula-

tion. If this study were possible, we would *know* the actual average and the actual amount of deviation from that average, and would then be in a position to place every individual in his proper position in the entire distribution. Since, in the ordinary run of events, it is impossible to measure an entire population, e.g., all 10-year old children in the city of Chicago, we turn to biometry for an interpretation of the results derived from the portion of the population actually measured. In other words, biometry tells us whether the sample is typical of the population universe from which it is drawn, and of which it is presumably representative.

The application of biometry to orthodontic research may be summarized in terms of its contribution to the study of the denture: the central tendency, or mean, median and mode; variability, the range, the mean deviation, the standard deviation and the coefficient of variation; reliability, the probable error, the standard error and the coefficient of reliability; relationships, the coefficient of correlation.

There is a single number, or a single measurement, which stands for a group of numbers or a group of measurements. This average becomes the central tendency of the series. The central tendency is a focal point to which numbers converge from both sides, and we then say that some numbers are less than, others more than, the average.

If we stop to analyze the meaning of the average as above stated, we find that, in very reality, we have found a single measurement representative of an entire group. It need not follow that this single number, or average, is identical with any of the numbers in the series; e.g., the average of $6 + 8 + 4 + 10$ is 7, even though the average 7, is not represented in the series.

Let us now give definite formulation to the concept of the average. If two series of palates were measured, we would naturally wish to know how the series differed. This we would do by ascertaining the average: adding all the measurements and dividing the sum by the number of individuals. The quotient is the average (the arithmetic mean). This may be expressed in convenient form as: (Σ = sum of)

$$M = \frac{\Sigma X}{N};$$

where M is the average of the measurements, ΣX is the sum of all the (X) measurements, and N is the number of individuals. If two groups were compared, we would state M_1 and M_2 as the means of the first and second, respectively.

There are two other measures of the central tendency, the median and the mode.

The median is the middle number in a series of numbers arranged in order of magnitude. The median measurement, for example, is one in a series of X number of measurements so chosen that there are as many measurements above as below the median. Let us take as an illustration the following series: 6 8 3 7 9 2 5; arranged in order of magnitude: 2 3 5 6 7 8 9, the median is 6, i.e., there are three numbers above, and three below the median. The mean is 5.71.

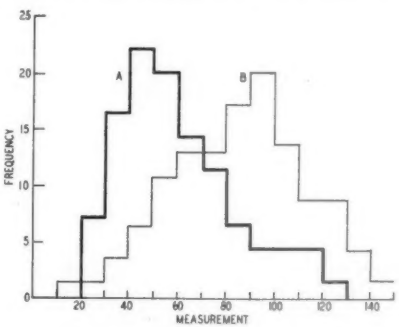
If we take an even number of measurements, the median is the number midway between the two middle numbers. For example: 17 16 9 15 7 21 2 30; arranged in order of magnitude: 2 7 9 15 16 17 21 30, the two middle numbers are 15 and 16. The median is therefore 15.5. The mean is 14.62.

The mode is ascertained by a scrutiny of the frequency curve after the data have been arranged in class intervals and plotted on a frequency polygon and

curve. It is the value at which the frequency curve is highest.

The three measures of central tendency may be illustrated by the accompanying chart. A glance at this diagram will call attention to two different types of asymmetrical curves, one of them, A, skewed positively, to the right, the other, B, skewed negatively to the left. The mean, median and mode will be identical if the distribution is symmetrical. If it is asymmetrical, or skewed, the three measures of central tendency will differ.

The Range.—With the range, we are introduced formally to the idea of variation. In the measures of the central tendency, we have noted that, in a series of



Asymmetrical or skewed distributions demonstrated by column diagrams.

figures, some will be less than, others more than, the number taken as the central value. In other words, we must now turn our attention to an analysis of the range as an indication of variability.

Let us take the following two sets of numbers: a. 15 20 25 30 35 40 45; b. 27 28 29 30 31 32 33.

The mean of each series is 30—they are identical in this respect. In the first series, there is a far greater scatter than in the second: in the first, the range is 30; in the second, it is 6. The two series may be compared as to central tendency and variability: central tendency: a. mean = 30; b. mean = 30; variability: range = 30; range = 6.

The range is valuable as a general indication of variability, but is basically unstable because it depends on the extreme cases, the highest and the lowest, as is shown in a third series, c: 15 28 29 30 31 32 45.

The range of 30 is equal to that of series a, but except for the first and last figures, the scatter is not really greater than that of b.

The Mean Deviation.—The mean deviation takes us a step farther in the analysis of variability. It expresses variation in terms of the deviation of a series of numbers from the mean. For example, let us note the following series of numbers: x, the series of numbers: 8 9 11 14 14 15 15 16 18 20; d, deviation from mean: 6 5 3 0 0 1 1 2 4 6; $\Sigma x = 140$, mean of $x = 14$; $\Sigma d = 28$, mean of $d = 2.8$.

In the first line, there is a series of numbers with a range of 12 and a mean of 14. In the second line are listed the deviations of each of the numbers from the mean, disregarding the sign + or −. The mean is obtained as the $\frac{\Sigma x}{n}$, and the mean deviation as the $\frac{\Sigma d}{n}$. Both of these are averages: the first, the average of the entire series; the second, the average of the deviation from the mean.

The mean deviation, by its size, is a measure of the scatter of a series about the mean.

The Standard Deviation.—The standard deviation is the most widely used measure of variability. It is, in a sense, much like the mean deviation, with the following exceptions: the deviations are squared before being summed; the sum is then divided by the number of cases; out of this quotient, the square root is extracted, to give the standard deviation.

The square root is necessary to reduce the measure of variability to the same order of magnitude as the original deviations.

The question may well be asked: Why use the standard deviation instead of the mean deviation? The reasons are inherent in the theory of the standard deviation itself. It is amenable to algebraic treatment. By the theory of errors and sampling, it can be demonstrated that the standard deviation is the measure of variability least affected by variations in sampling. It bears a convenient relationship to the normal or probability curve. Finally, the computation of the standard deviation is necessary to the determination of the coefficient of variability and the coefficient of correlation.

The standard deviation is sometimes written SD, but most frequently is written as σ (sigma) and expressed by the formula:

$$\sigma = \sqrt{\frac{\Sigma d^2}{n}},$$

where d represents the deviations from the means of the series, Σd^2 is the sum of squares of all deviations and n is the number in the series.

The standard deviation derives its value from the fact that given the mean and the σ of a distribution, we can make certain very definite statements concerning the population from which the sample was drawn. For example, let us say that the bizygomatic breadth in a group of 8 year-old white boys is 119.99 mm., with a standard deviation of 3.94 mm. We may interpret this to mean that approximately 68 per cent (this value has been determined mathematically) of the total population of 8 year-old white boys will possess bizygomatic breadths between 119.99 mm. + 3.94 mm., and 119.99 mm. − 3.94 mm., or between 123.93 mm. and 116.05 mm. In other words,

TABLE 1.—APPLICATION OF STANDARD DEVIATION TO INDIVIDUAL CASE

Facial Characters	Actual Measurements in Boy Aged 11 Yr. 6 Mo. (1)	Measurements in Boys Aged 11-12 Yr. (2)	S.D. of Characters in Boys Aged 11-12 Yr. (3)	Col 1-Col 2 (4)	Col 4 / Col 3 (5)
TA to N	88.0	89.33	3.43	−1.33	−0.39
TA to UIGM	91.0	89.44	4.10	+1.56	+0.38
TA to UIIM	95.0	91.56	4.02	+3.44	+0.86
TA to LIGM	87.0	90.13	3.90	−3.13	−0.80
TA to MP	98.5	103.02	4.17	−4.52	−1.08
N to U Inc.	65.5	69.38	3.68	−3.88	−1.05
N to SNP	41.5	43.55	3.07	−2.05	−0.67
N to SMP	99.5	103.59	4.81	−4.09	−0.85
L Inc. to SMP	37.5	38.00	2.30	−0.50	−0.22

The abbreviations employed are:

TA to N	Transmeatal axes to nasion.
TA to UIGM	Transmeatal axes to upper incisor gum-margin.
TA to UIIM	Transmeatal axes to upper incisor incisal-margin.
TA to LIGM	Transmeatal axes to lower incisor gum-margin.
TA to MP	Transmeatal axes to mental point.
N to U Inc.	Nasion to incisal-margin of upper incisors.
N to SNP	Nasion to subnasal point.
N to SMP	Nasion to submental point.
L Inc. to SMP	Lower incisor (incisal margin of I1) to submental point.

we may conclude that 68 per cent will be found between the mean and $\pm 1\sigma$.[1] This has been verified statistically so that the following is true: (M = mean, σ = standard deviation).

In 10,000 cases $M \pm 1\sigma = 6824 = 68.2$ per cent; $M \pm 2\sigma = 9545 = 95.4$ per cent; $M \pm 3\sigma = 9973 = 99.7$ per cent; $M \pm 4\sigma = 10000 = 100.0$ per cent.

So far so good. The orthodontist is interested in the specific instance of variation in terms of its relation to the statistical statement of variability. Matthew Young, in his thorough study of facial growth in children, offers an excellent example of the application of the standard deviation to an individual case.

The method of comparison is as follows: The measurements on the individual to be investigated are tabulated; then, the average for the appropriate age (also sex and stock) group, and next the S.D. of the characters of the age group. Then, the differences between the individual and the average are calculated according to sign. Finally, the differences are divided by the S.D. of the group characters. The resultant values (column 5) are then referred to the following table of probabilities: If the ratio is 1.0, one child in six has the character more emphasized in the given direction; if 1.5, one child in fifteen; if 2.0, only one child in forty-four; if 2.3, only one child in ninety-three; if 2.5, only one child in 161; if 3.0, only one child in 740.

The difference is not significant unless it exhibits a difference in the given direction (+ or −) that is not equaled or exceeded more than once in more than forty-four times, i.e., when the ratio is 2 or over. Values between 1 and 2 indicate characters that, to quote Pearson, "contribute something to individuality, but not to . . . markedly personal features."

In the example quoted above, the differences range from + 0.86 to − 1.08. In none of the facial characters measured does the individual vary beyond the bounds of normal or chance variation.

The Coefficient of Variation.—The coefficient of variation as a measure of relative variability serves the important purposes of rendering comparable the variability of differing quantities; e.g., the variability of head measurements as contrasted with faciodental measurements. It is a percentage statement of variability, according to the formula:

$$C.V. = \frac{100\sigma}{M},$$

where C.V. is the coefficient of variation, σ is the standard deviation, and M is the mean of the specific character measured. An example will illustrate the application and interpretation of the C.V.

The head length of sixty male Seminole Indians was ascertained to average 190.0 mm.; S.D., 6.34 mm. The morphologic face height of the same group averaged 122.9 mm.; S.D., 6.81 mm. Taken by themselves, the standard deviations as an absolute measure of variability are practically the same. If the C.V. is calculated, it is found that, for the head length, the coefficient of variation is 3.34, and for face height, it is 5.56. Expressed as a percentage, head length is $\frac{3.34}{5.5}$, or 60.2 per cent, as variable as face height.

The Probable Error.—Up to this point, we have been concerned chiefly with the interpretation of the data derived from the study of a group directly in terms of the import for that group. We have as yet no means of knowing whether the group is representative of the population from which it was drawn and of which it is supposedly typical. To

1. The σ is not expressed as + or − in tabulation. The mean is given, and the σ, both in separate columns, or separately written, e.g., mean = 43.10 mm., standard deviation = 2.08 mm. The $\pm$ designation is reserved for the standard error and probable error.

state the problem in simpler terms: we wish to find out whether our sample is typical. Assuming that we have measured one group of fifty 8-year-old boys and obtained a set of averages for the several characteristics measured, what are the chances that, in a second group of fifty 8-year-old boys, drawn from the same population, the averages will be the same or nearly the same?

I would, for a moment, call attention to the phrase "drawn from the same population." This means exactly what it says. For example, if we were considering all 8-year-old boys in Chicago and were measuring them in groups of fifty, we could not compare a group of fifty from "back of the yards" with a group from the "Gold Coast." A number of differences, not due to chance, would supervene: nationality, state of physical development, differences in nutrition, health differences, etc. We may, in this instance, compare only absolutely identical groups of fifty. It is at once obvious, therefore, that comparisons of similar age and sex groups from the New York slums, from Porto Rico and from the Chicago ghetto are invalidated by essential differences independent of chance.

The answer to the question of comparability of samples from the same population is afforded by the probable error of the arithmetic mean which is expressed by the formula: Probable error of the arithmetic mean[2] $= 0.67449 \frac{\sigma}{\sqrt{n}}$, where σ is the standard deviation of the sample and n is the number of individuals in the sample.

In the discussion of the standard deviation, we noted that the bizygomatic breadth for 8-year-old white boys was 119.99 mm. The probable error of this average was found to be 0.28 mm., written as 119.99 ± 0.28. The interpretation of this notation is that the chances are even that the true mean lies between $119.99 + 0.28$ and $119.99 - 0.28$, if we assume that the noted deviations are due to chance alone. If, then, a second group of 8 year-old white boys were to be measured, the chances that the bizygomatic width will be between 119.71 mm. and 120.27 are even, 1:1. If the range is extended to two times the probable error, or three times, the probability that the true mean will fall within the range is greatly increased. The odds are given in Table 2, accordingly as the range is $\pm$ 1 PE, $\pm$ 2 PE, etc.:

TABLE 2.—ODDS IN VARIOUS RANGES

PE*	Chances Even
2 PE	4.5 to 1
3 PE	21 to 1
4 PE	142 to 1
5 PE	1,310 to 1
6 PE	19,200 to 1
7 PE	420,000 to 1
8 PE	17,000,000 to 1
9 PE	1,000,000,000 to 1

*Probable error.

The probable error is really an if: if we measure another sample, presumedly identical with the first, what will the variability be with respect to the mean of the first sample?

The probable error may also be applied to the standard deviation, the coefficient of variation, and the coefficient of correlation. Since the interpretation is the same as for the arithmetic mean, we shall merely note the formula:

$$\text{PE of } \sigma = 0.67449 \frac{\sigma}{\sqrt{2n}}$$

where σ is the standard deviation and n is the number in the sample.

$$\text{PE of C.V.} = 0.67449 \frac{\text{C.V.}}{\sqrt{2n}}$$

where C.V. is the coefficient of variation

2. For series numbering less than fifteen, PE of the mean is $0.67449 \frac{\sigma}{\sqrt{n-3}}$.

and n is the number in the sample.

$$\text{PE of } r = \frac{1-r^2}{\sqrt{n}},$$

where r is the coefficient of correlation and n is the number in the sample.

The use of the PE of the mean may be illustrated by an example. Several groups of Chipewyan Indians in Canada were measured, and it was found that, for stature in centimeters, the results were as follows:

Stature and PE of Chipewyan at Chipewyan, 167.1 ± 1.27; Chipewyan at Fond-du-lac, 164.7 ± 0.78. The difference in stature is 2.4 cm.

The question to be answered is whether the observed difference in the mean stature of the two groups of Chipewyan Indians is statistically significant. This may be expressed by the formula:

$$\text{PE diff.} = \sqrt{PE_1^2 + PE_2^2}.$$

The probable errors ± 1.27 (PE_1) and ± 0.78 (PE_2), on being squared, will give the values 1.6129 and 0.6084, which added together give 2.2213, the square root of which is 1.490. This result is known as the probable error (PE. diff.) of the difference between the two statures. If the PE diff., 1.490, be divided into 2.4 the answer is 1.6. In other words, the difference between the two statures is 1.6 times greater than the PE diff., or the ratio is as 1.6 is to 1.0.

This ratio must be referred to the following table, which gives the odds when a difference is divided by the probable error of that difference. (Table 3.) (Compare with data for the PE.)

On consulting Table 3, it will be seen that the chances are 2.57 to 1.0 that the difference 2.4 cm. would occur in the mean statures of the compared groups were larger numbers to be measured. The odds 2.57 to 1 are obviously too small to be significant, for random chance alone might well result in a greater difference than 2.4 cm. As a general rule, differences less than 22 to 1 (i.e., Diff. / PE diff. of 3.0) are not considered significant. If values of 4.0, 5.0, 6.0, or over, are found, the difference is statistically significant.

The Standard Error.—The standard error, like the probable error, is a measure of the validity of the conclusions derived from the sample, an expression of the reliability of the sample in terms of the entire population from which it was drawn.

There is this essential difference between the standard error (SE) and the probable error (PE). The former is used

TABLE 3.—ODDS WHEN DIFFERENCE IS DIVIDED BY PROBABLE ERROR OF DIFFERENCE

Difference	Odds
1.0	1.0 to 1.0
1.6	2.57 to 1.0
2.0	4.64 to 1.0
2.2	6.25 to 1.0
2.5	9.90 to 1.0
2.6	11.58 to 1.0
2.7	13.58 to 1.0
2.8	15.96 to 1.0
2.9	18.82 to 1.0
3.0	22.24 to 1.0
4.0	142.30 to 1.0
5.0	1341.00 to 1.0
6.0	19300.00 to 1.0
7.0	427000.00 to 1.0

when only two samples from the total population are to be compared. The PE is used only when a large number of samples are to be compared. For example, the SE is preferable in comparing two samples of fifty children each from among 8-year-old boys; the PE is preferable to indicate probability when, for example, two samples of fifty each are taken every year for ten years (a total of twenty samples), to study trend.

The SE is written:

$$SE = \frac{\sigma}{\sqrt{n}}$$

It is at once obvious that the PE is merely 0.6745, or approximately two-

thirds of the SE. Both are measures of the true position of the derived mean value, but whereas for the PE the chances are even that the true mean lies between $M \pm PE$, for the SE the chances are about 68 in 100 that the true mean lies between $M \pm SE$, and 95 in 100 that the true mean lies between $M \pm 2SE$.

If we were to compare two means, M_1 and M_2, with respect to their standard errors, SE_1 and SE_2, a difference may be considered significant, or one not due to chance alone, when it exceeds twice its standard error, or the square root of the sum of the square of the standard errors of the compared means. This may be written, simply, that a difference is significant when $M_1 - M_2$ is greater than $2\sqrt{SE_1^2 + SE_2^2}$.

The Coefficient of Reliability.—Much is being made at present of the coefficient of reliability as a measure of the reliability of repeated observations made on the same sample. It is, in fact, a measure of consistency, and may be applied to the accuracy of the measurements chosen, the instruments used or the technic of the observer. One method of using the coefficient of reliability is to ascertain the coefficient of correlation (see below) between the two sets of results. This is the method of self-correlation. The derived values will range from 0 to + 1.0, the former indicating complete unreliability, the latter complete reliability. As a general rule, a value of + 0.80 is a minimum for reliability, while + 0.90 to + 1.0 gives assurance of reliability.

If we do not wish to use the method of self-correlation, we may do either of two things: (1) greatly increase the number in the series, or (2) repeat the measurements and their duplicate (i.e., second trial) twice and correlate the averages. The measure of the effect, without the actual performance of either (1) or (2), may be secured by Spearman's "prophecy" formula:

$$r_x = \frac{Nr}{1 + (N-1)r}.$$

Let us note an example. Suppose that the result of the self-correlation of a test is + 0.70, and that we wish to know the effect of doubling the size of the sample. Substituting $r = + 0.70$ and $N = 2$ and solving for r_x we obtain

$$r_x = \frac{2 \times 0.70}{1 + 0.70} = 0.82$$

Doubling the size of the sample, therefore, increases the self-correlation—the reliability—from + 0.70 to + 0.82.

We may use the prophecy formula in another manner. Suppose that in a self-correlation, we may get a result of + 0.80, and wish to know how much the series must be lengthened (or the measurements repeated) to obtain a reliability coefficient (r_x) of + 0.95. Substituting $r = + 0.80$ and $r_x = 0.95$, we have

$$0.95 = \frac{0.8N}{1 + 0.8N - 0.8} = \frac{0.8N}{0.2 + 0.8N},$$

$$0.04N = 0.19$$

$N = 4.75$ or 5.00 (in whole numbers).

The series must be five times its present length, or the measurements repeated (with their duplicates) five times in order to raise the coefficient from + 0.80 to + 0.95.

The reliability coefficient is essentially a check on the accuracy of observation. It is likewise a fair measure of the validity of the size of the sample as a basis of interpretation.

The Coefficient of Correlation.—In the study of the growing child, in the analysis of the craniofacial adjustments involved in tooth eruption, and specifically in orthodontic research, it is important to know the relationship, the interdependence of certain dimensions. If the palate gains in breadth, will it gain in length, and if so what will be the relative—the proportional—gain? We turn

to the coefficient of correlation for a numerical expression of the relationship between, for example, palatal breadth and palatal length. Let us see how this is done.

The series of measurements of palatal breadth will comprise group X, those of palatal length group Y. The deviations from the means of the two series, X and Y, will be $x_1, x_2, x_3 \ldots x_n$ and $y_1, y_2, y_3 \ldots y_n$, respectively. The standard deviations will be σ_1 and σ_2. The number of observations will be n. Accordingly, the formula may be stated:

$$r = \frac{\Sigma xy}{n\sigma_1\sigma_2},$$

where r is the Pearson coefficient of correlation.

The coefficient and correlation ranges from + 1 to − 1, the first being positive correlation; the second, negative correlation. Values hovering around zero signify no correlation.

The method of finding a positive coefficient is very simply demonstrated in Table 4.

TABLE 4.—METHOD OF FINDING POSITIVE COEFFICIENT

X	Y	x	y	x^2	y^2	xy
1	2	−2	−4	4	16	8
2	4	−1	−2	1	4	2
3	6	0	0	0	0	0
4	8	+1	+2	1	4	2
5	10	+2	+4	4	16	8
				10	40	20

Number = 5
Mean of X = 3
Mean of Y = 6
$\Sigma xy = 20$

$$\sigma \text{ of } X = \sqrt{\frac{10}{5}} = \sqrt{2}$$

$$\sigma \text{ of } Y = \sqrt{\frac{40}{5}} = \sqrt{8}$$

$$r = \frac{+20}{5.\sqrt{2}.\sqrt{8}} = +1.0$$

This is an example of perfect positive correlation: For an increase of 1 unit in the X series, there is a uniform increase of 2 units in the Y series.

We may take the same series to demonstrate a negative coefficient. (Table 5.)

TABLE 5.—NEGATIVE COEFFICIENT

X	Y	x	y	x^2	y^2	xy
1	10	−2	+4	4	16	−8
2	8	−1	+2	1	4	−2
3	6	0	0	0	0	0
4	4	+1	−2	1	4	−2
5	2	+2	−4	4	16	−8
				10	40	−20

Number = 5
Mean of X = 3
Mean of Y = 6
$\Sigma xy = -20$

$$\sigma \text{ of } X = \sqrt{\frac{10}{5}} = \sqrt{2}$$

$$\sigma \text{ of } Y = \sqrt{\frac{40}{5}} = \sqrt{8}$$

$$r = \frac{-20}{5.\sqrt{2}.\sqrt{8}} = -1.0$$

This is an example of perfect negative correlation: For an increase of 1 unit in the X series, there is a uniform decrease of 2 units in the Y series.

Finally, we may take the same series to demonstrate no correlation. (Table 6.)

TABLE 6.—NO CORRELATION

X	Y	x	y	x^2	y^2	xy
1	8	−2	+2	4	4	−4
2	2	−1	−4	1	16	+4
3	6	0	0	0	0	0
4	10	+1	+4	1	16	+4
5	4	+2	−2	4	4	−4
				10	40	0

Number = 5
Mean of X = 3
Mean of Y = 6
$\Sigma xy = 0$

$$\sigma \text{ of } X = \sqrt{\frac{10}{5}} = \sqrt{2}$$

$$\sigma \text{ of } Y = \sqrt{\frac{40}{5}} = \sqrt{8}$$

$$r = \frac{0}{5.\sqrt{2}.\sqrt{8}} = 0$$

This is an example of no correlation: For an increase of 1 unit in the X series,

there has been no uniform change in the Y series.

A concrete example will serve to illustrate the application of the coefficient of correlation. According to Tildesley, the relation between palatal length, from the midalveolar point to the base of the posterior nasal spine, and the palatal breadth, between the outside of the second bicuspids, is expressed by $r = +.50$, approximately (actually $+ 0.47 \pm 0.08$). The mean length of palate is 49.8 mm., with σ of 3.3 mm.; the mean breadth of palate is 49.5 mm., with σ of 2.7 mm. If $r = + 0.50$, it means that palatal length and breadth are related to the following extent: If the palate increases its length by its standard deviation to 53.1 mm. (49.8 + 3.3), the palatal breadth will become greater by one-half (since $r = + 0.50$) of its standard deviation; i.e., palatal breadth will be 49.5 mm. + 0.5 (2.7 mm.), or 49.5 + 1.35 = 50.85 mm. We are here assuming a normal development unaffected by disturbed growth.

In other words, there is a direct positive relation between palatal length and breadth. It is hardly necessary to add that if r had been equal to $- 0.50$ the proportions would have been reversed.

The coefficient of correlation is, therefore, a statistical indication of relationship —more than that, it measures the degree of relationship, positive, negative or nonexistent. It must be pointed out that there are degrees of positive and negative correlation ranging from 0 to + 1 and 0 to − 1, respectively. In a sense, it becomes a matter of statistical judgment whether, in a given instance, + 0.30 or − 0.30 are significant values, or + 0.20, − 0.20, + 0.40, − 0.40, etc. In general a value of 0.30, either + or −, is considered slightly significant. Obviously, significance increases as the value exceeds ± 0.30.

CONCLUSION

Biometry has not solved any of the orthodontist's problems, but it has given to the serious student of orthodontic problems a most efficient tool with which to work. It has given him some idea of the frequency of a given trait in the specific sample studied—the average; it has given him some idea of the variability of that trait—the range, the mean deviation, the standard deviation, the coefficient of variation; it has given him some idea of the reliability of his study of that trait based upon the sample—the probable error, the standard error, the coefficient of reliability; and it has given him some idea of the interrelationship of that trait—the coefficient of correlation. Most important of all, it has enabled him not to rely on his sample alone, but to judge the size of sample of reasonable reliability (it must number at least fifty and preferably 100) as representative of the entire population from which it was drawn. He can be reasonably certain that his conclusions statistically drawn and statistically verified can be applied to *all* the population represented by the sample. But biometry can never do more than define the normal as a statistical fiction. Nor, indeed, can it presume to analyze underlying causal factors.

RESEMBLANCE OF CERTAIN TUMORS OF THE HYPOPHYSIS TO TUMORS OF THE JAW*

By E. B. FINK, M.D., Chicago, Ill.

THE hypophysis, or glandula pituitaria, is a small gland suspended from the base of the brain. It weighs less than 1 gm., is about the size of a large pea, is oval and flattened on top and lies within a bony framework, the sella turcica, in the sphenoid bone. Although it is the smallest of the glands of internal secretion, it possesses a complicated histologic structure and exerts a number of important functions including the regulation of some of the other endocrine glands. Histologically, the hypophysis is divided into two distinct lobes: a glandular anterior lobe and a neural posterior lobe, which develops as a downward growth from the floor of the third ventricle. Hyperfunction of the anterior lobe results in acromegaly, a syndrome characterized by overgrowth of the bones and acral parts, with prognathism when it occurs after puberty. Before puberty, it causes gigantism. In these cases, there is usually a tumor composed of eosinophilic cells. A new syndrome recently described by Cushing as pituitary basophilism is characterized by excessive development of the sex glands and secondary sex characteristics due to hyperfunction of the basophilic cells. Hypofunction of the anterior lobe before puberty results in dwarfism; after puberty, in dystrophia adiposogenitalis.

The most common pathologic lesion of the hypophysis is the tumor, which may be derived from functioning anterior lobe cells or from squamous epithelial cell rests of the anlage of the hypophysis. It is the latter class of tumors which are of interest in oral pathology. The precise nature of these tumors was first clearly demonstrated by Erdheim, who showed that masses of squamous epithelial cells frequently occur in the normal hypophysis. They are not found in the embryo or in infants, but seem to increase with age. The largest masses were found in elderly persons. The most common distribution is at the insertion of the stalk where it joins the anterior lobe, and in the terminal swelling. They also occur on the lateral and posterior surfaces of the infundibulum, and in the nasopharyngeal hypophysis. According to Erdheim, the explanation of the presence of squamous epithelium in the hypophysis is simple. The hypophysis was originally a gland of external secretion. Its duct, like the thyroglossal duct was lined by squamous epithelium, and the cell masses represent the embryonal remnants of the primitive craniopharyngeal canal. Tumors of the hypophysis composed of squamous epithelium arise in these embryonal remnants. Erdheim called them pituitary duct tumors. Cushing speaks of them as craniopharyngeomas. A number of writers have termed them pituitary adamantinomas. Erdheim recognized their histologic resemblance to adamantinomas, but maintained that they were not identical.

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This class of tumors occurs most commonly in young individuals and may reach the size of a tennis ball. They may be either entirely cystic or solid and often are both solid and cystic. Degenerative changes are frequent, particularly cyst formation, calcification and even ossification. Because of their location, they produce early and serious impairment of vision and signs of increased intracranial pressure.

The cysts are lined with stratified squamous epithelium. The contents consist of clear serous fluid, which may be chocolate colored from old hemorrhage and often contains cholesterol crystals; or the contents may be mucoid. The parenchyma of the solid tumors is composed of masses of squamous epithelium in branching cords or nests frequently in palisade arrangement. The outer layer of cells are tall thin columnar cells with their long axes in parallel series, and in close contact with each other. The nucleus is in the center of the cell and is elongated. Within this layer, which is only a single cell thick, there is another layer three to four cells thick, consisting of oval cells with a centrally placed nucleus staining less darkly than the peripheral cells. The innermost cells are larger and often triangular shaped and stain rather faintly.

The stroma varies from a mature type of connective tissue to a young embryonic type. It has a tendency to undergo various forms of degenerative changes including hyalinization, calcification and bone formation. Within some of these tumors, there is a glial cell reaction.

Many of the gross and microscopic features of this class of pituitary tumors are identical with those of adamantinomas of the jaw. The cysts are lined with squamous epithelium resembling epithelium of the mouth, just as are the cystic adamantinomas. The contents of the cysts are more likely to contain cholesterol crystals and old hemorrhage. Because of their location, the clinical symptoms are serious, and they often terminate fatally.

The solid tumors have the following points in common with the solid adamantinomas: Both consist essentially of a parenchyma which is made up of nests of squamous epithelial cells, basal cells and stratum spinosum, connected by intercellular bridges. Pale, tall cylindrical cells are arranged in regular palisade formation. There is an absence of true pearl formation and a great tendency to hydropic degeneration of the epithelial cells and cyst formation. The basal layer of epithelium resembles amyloblasts.

The differences are less marked, but not so fundamental as formerly believed. Keratohyalin has been found in pituitary tumors by a number of investigators, but is absent in adamantinomas. According to Siegmund, true enamel is never found in pituitary tumors, which have a greater tendency to undergo calcification and ossification than do adamantinomas. The stroma of pituitary tumors sometimes consists of glial tissue, which never occurs in adamantinomas. Because of their intracranial location, the craniopharyngeomas are much more malignant, but both classes of tumors have a tendency to destroy the surrounding tissue by pressure.

Recently, Pflüger and Schürmann have made a valuable contribution to the subject of tumors of the hypophysis containing elements derived from the oral ectoderm. Their monograph is based upon a study of two cases containing numerous fully formed teeth.

The first case was that of a 6-year-old child with a tumor the size of a man's fist at the base of the brain. The lesion was partly cystic and partly ossified and contained numerous teeth about the size

of apple seeds. The parenchyma of the tumor consisted of masses of squamous epithelium and was genetically of the same type as the other pituitary tumors of fetal origin.

The second case was that of a woman, aged 23. There was a tumor at the base of the brain arising from the sella, and surrounded by a dural capsule. It was oval and measured 5 by 3.5 by 3 cm. This tumor also contained numerous teeth and many cystic spaces. The epithelium of this tumor had undergone a greater degree of differentiation and teeth were present in all stages of formation from tooth germs to fully formed teeth, without roots.

This type of tumor is extremely rare, only one other example, the case of Beck, reported as a teratoma, being on record. Histologically, it corresponds to the odontomas. Pflüger and Schürmann have proved that their tumors belonged to the same class as those described by Erdheim and which he called hypophyseal duct tumors, because they contain squamous epithelium of the same type. More important is the fact that the occurrence of tumors in the hypophysis containing fully formed teeth, no matter how rare, is the final proof that this class of tumor is derived from primitive oral ectoderm.

What is the explanation for the presence of squamous epithelial cell masses found in normal hypophyses and the occurrence of tumors resembling adamantinomas of the jaw in almost all respects, and though rare, the odontomas? The answer is to be found in the embryologic development of the anterior lobe of the hypophysis, which arises from the roof of Rathke's pouch, a part of the primitive stomodeum.

The hypophysis develops from two separate anlages both of which are derived from ectoderm. One portion originates in the oral diverticulum or buccal cavity. The second, forming the posterior lobe and infundibulum, is a downward growth from the interbrain. In the fourth week of embryonal life, the cephalic end of the embryo with the forebrain separates from the amniotic sac, a hollow forming under the forebrain, the buccal cavity. Soon, the frontal protuberance grows ventrally and the buccal cavity broadens out dorsally, its dorsal tip pushing in between the anterior end of the corda and the brain.

The dorsal tip of the buccal cavity in the region of the stomodeum becomes narrowed, a pocket-like diverticulum, Rathke's pouch, resulting. At this time, the pharyngeal mucosa has not yet broken through between the buccal cavity and the stomodeum. This diverticulum grows upward, becomes almost completely pinched off and forms the hypophyseal saccule, which remains connected with the pharyngeal cavity through the embryonal hypophyseal duct. This duct later becomes obliterated. Cell masses extend from the wall of the saccule and increase in amount, continuing to fill the lumen and forming the embryonal anlage of the anterior lobe.

Along the entire path of development of the hypophyseal saccule, embryonal remnants not infrequently appear, and these are the starting point in the development of tumors resembling those found in the jaw.

The presence of tumors resembling adamantinomas and odontomas in the hypophysis arising in remnants of embryonal oral epithelium may be taken as evidence that these tumors, when they occur in the jaw, probably also arise in embryonal oral epithelium.

In my collection of pituitary tumors, there are two which possess the histologic characteristics commonly associated with adamantinomas of the jaw.

REPORT OF CASES

CASE 1.—A school girl, aged 13, suffered from gradually increasing blindness, headache, vomiting, polyuria, hypersomnia and mild obesity. Transphenoidal operation was followed by subtemporal decompression. Death ensued. At necropsy, a large craniopharyngeal epithelioma was found at the base of the brain.

The brain was compressed by a tumor the size of a goose egg which lay at the base of the brain, taking origin from the region of the hypophysis. The sella was slightly eroded and somewhat enlarged. Most of the tumor had grown out of the sella and pressed the brain upward in all directions. On sagittal section, the floor of the third ventricle was seen to be pushed upward and the cavity reduced to a narrow space. The lateral ventricles were encroached on. The corpus callosum was thinned, as were the optic tracts, which stretched like a ribbon over the surface of the advancing tumor. The third and eighth cranial nerves were compressed. Posteriorly, the tumor had pushed the pons and medulla backward and downward so that they were at a right angle to the cerebrum.

The tumor was a well-circumscribed oval mass and measured 5 by 4 cm. It extended from the tip of the frontal lobe to the pons, growing laterally to the cerebral peduncles and temporal lobes. On section, the anterior and upper portions appeared gray-red and friable. The posterior and inferior portions were gray and in consistency somewhat firmer than brain tissue. No trace of the hypophysis was seen.

Sections from the more solid portions of the tumor were composed of squamous epithelial cells surrounding vascular spaces of varying sizes lined by a single layer of endothelium. The masses of epithelial cells varied in thickness from two to fourteen cells. Except for the blood filled spaces, these sections resembled very closely a soft adamantinoma. The centers of the large masses were undergoing necrosis. The cells lying free were round or oval with pale vesicular nuclei. In some of the necrotic areas, the cytoplasm had disintegrated and appeared as fine pink granules with nuclei resembling lymphocytes.

CASE 2.—A young colored girl who was admitted to the Chicago State Hospital acutely ill died a few hours after admission. The formalin hardened specimen consisted of the brain and, at its base, in the region of the optic chiasm, a tumor mass about 6 by 4 by 2 cm. The anterior limit of the tumor was near the tip of the temporal lobes. Posteriorly, it rested on the medulla. On surfaces made by cross sections of the brain, the tumor was seen to push up the floor of the third ventricle and occupy its cavity. The right temporal lobe was infiltrated at one point over an area about 5 mm. in diameter. Posteriorly, it extended to and invaded the pons. The main tumor mass contained calcified areas.

Microscopic sections from different portions of the tumor showed extreme variations in histologic structure. Some areas contained concentric hyaline masses with many foreign body giant cells at the periphery, some with cells resembling the lacunae of cartilage. In places, there was infiltration with calcium salts. One or two such areas resembled bone trabeculae, but did not contain haversian canals. Other sections showed masses of epithelial cells like prickle cells of the skin, shading off into spaces resembling thyroid gland tubules. Strands of dense connective tissue, with occasional focal areas of dense round-cell infiltration were seen near the hyaline masses. The blood supply of the tumor was poor, consisting of occasional thin-walled blood vessels.

SUMMARY

There exists a well known group of tumors of the hypophysis variously termed craniopharyngeal duct tumors, craniopharyngeomas and pituitary adamantinomas, which, in many respects, histologically resemble tumors of the jaw, particularly those derived from the oral ectoderm. Their chief characteristics are that they occur in young persons and are either cystic or solid and frequently calcified. Histologically, the solid forms are composed of masses of epithelium in cords or nests, which frequently undergo various forms of degenerative change such as hyalinization, cyst formation, calcification and even true bone formation, the characteristic features of adamantinomas of the jaw being reproduced almost completely. In the literature, there are recorded three cases in which pituitary tumors contained fully formed teeth. These tumors can be said to correspond to odontomas of the jaw. The marked resemblance of these brain tumors to

tumors of the jaw may be explained by the fact that they arise in remnants of the epithelium of Rathke's pouch in the embryo, which oral ectoderm is derived from.

VALUE OF BACTERIAL CULTURING IN PULP CANAL THERAPY*

By ALFRED WALKER, D.D.S., New York City

IN no branch of dental practice is the judgment and skill of the operator put to the test more severely than in dealing with the pulpless tooth. The old axiom that the good dentist must possess mechanical skill and craftsmanship still holds good, but in dealing with biologic problems such as are presented by the pulpless tooth, digital dexterity must be supplemented by an ability to comprehend pathologic conditions occurring in the field, and to apply knowledge more directly toward the health and well-being of the patient than is the case in simple restorative operations.

I do not mean to suggest that the health of the patient should not in every instance be the first consideration; but in the presence of conditions so intimately associated with health and oftentimes life, biologic considerations should be strongly emphasized, mechanical and esthetic factors receiving secondary consideration.

In accepting the pulpless tooth as an object of conservation, we must of course satisfy ourselves that, from a biologic standpoint, it may be made a safe inhabitant of the mouth. If, on the other hand, we assume the attitude that all pulpless teeth should be removed, we must, in order to be logical, base our conclusions upon at least reasonable evidence supporting our attitude.

With the thought of conservation rather than that of the opposing practice in mind, I shall confine my remarks to what I consider the fundamentals of a rational method of treating teeth whose pulps have been involved.

Let us, at the outset, understand that the obligations of the dentist are: to maintain the teeth and their investing tissues in a state of health so that the masticatory efficiency is in keeping with oral as well as general health; and in the execution of the foregoing, to avoid jeopardizing the general health, because, fundamentally, it is to maintain general health that dental work is instituted.

Since the pulpless tooth is a dental problem, its successful handling depends on how fully these obligations are realized. If, when retained, it will not injuriously influence health, and this could be proved definitely, there is no question that it would materially aid in the discharging of the first obligation mentioned. Therefore, the problem simmers down to this: Is conservation of the pulpless tooth a violation of the second obligation mentioned?

In no instance may these obligations be evaded or slighted, and accepting them as a basis for determining our attitude, we turn our attention to the first

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step in technic: diagnosis. This implies a careful study of all conditions surrounding the tooth or teeth in question. First, is it from a strategic standpoint desirable to save the tooth? Secondly, is it a savable tooth? This may be determined by a consideration of the physical condition of the tooth and of the patient, supplemented by good roentgenograms.

The latter show variations from the normal which must be translated into possible indications of pathologic activity. This activity plus the clinical findings reveal the cause. This is diagnosis.

Should the prognosis prove favorable, the operator, to succeed in his treatment, must employ a technic that adheres faithfully to the laws of surgery and must have the full cooperation of the patient.

While all of the foregoing applies essentially to the treatment and filling of pulp canals where apicoectomy is not contemplated, it applies with equal force to teeth on which it is planned to perform this operation.

Wherein, then, is the latter operation indicated? Before answering this question, let us consider upon what evidence success in the treatment of a pulpless tooth is based.

If we accepted the obligations mentioned above as fundamental, their requirements must be fully satisfied. This implies the establishment and maintenance of health based upon a careful survey of the clinical and roentgenographic evidence supplemented by such laboratory evidence as the case demands. This is all that is required as evidence of the successful treatment of any lesion.

The handling of the pulpless tooth demands the exercise of skill and judgment beyond that required by any other dental operation and, in undertaking to meet the situation which it presents, we must satisfy ourselves whether, properly handled, it may not be safely retained in the mouth.

If we are to support the affirmative, we must base our attitude upon a belief fortified by adequate evidence that, from the biologic standpoint, the pulpless tooth which measures up to such standards as we may set may be safely retained. If we propose to take the contrary view, we must base our conclusions upon evidence that will with the same degree of reasonableness and logic support this attitude.

My belief that the pulpless tooth when properly selected and properly handled may safely be retained is based upon careful observation and the conscientious consideration of all factors involved. By way of explaining the implication in the preceding sentence, let me revert to the thought expressed earlier in this paper that the first requisite in the consideration of the pulpless tooth is that it shall not jeopardize the general health of the patient; and here we have to consider not merely those gross disease conditions such as kidney and cardiac disorders, neuritis and iritis, but also certain less well marked derangements of the general health expressing themselves as secondary anemia, asthenia, etc. Of this latter group, we have little exact knowledge, but we are not lacking in evidence of a frequent relationship between them and focal infection. I only mention this to emphasize the fact that, in deciding whether the patient is free from all trace of focal infection, we must assure ourselves of his general well-being as well as of his freedom from major complaints.

Before we can proceed to a consideration of the topic suggested in the title of this paper, it will be necessary to touch briefly on the subject of diagnosis. It goes without saying that before we undertake root-canal therapy, it is essential that we determine whether the tooth is infected or free from infection and also,

if infected, whether this condition has brought about irremediable damage to the surrounding tissues. It is also necessary to determine as far as possible the probable reaction of the patient to the operation. The latter point may involve consultation with the patient's physician.

Having decided that the tooth is a proper subject for treatment, we come directly to a consideration of the bacterial phase of the subject. Regardless of the condition of the tooth when treatment is undertaken, pulp-canal therapy demands strict adherence to a surgically clean procedure. At this point, it may be well to make a distinction which is recognized by bacteriologists and by surgeons between a bacterially clean procedure and a surgically clean procedure. It may not be generally known that the requirement for the former is much more strict than for the latter. In bacterial culture work, precautions must be taken which are not demanded, and, in fact, are not possible in surgical practice. The reason for the success of operations performed under the lesser requirement is that the body, even when seriously diseased, is capable of destroying a certain number of organisms. Were it not for this fact, few surgical operations, even when performed with the greatest care, would be followed by the uneventful healing to which we are accustomed in modern times.

As evidence of the ability of the body to cope with pathologic organisms in many instances and its inability to so withstand them in others, let me call attention to the phenomena of bacterial sensitivity. These are exemplified in the tests which are made to determine the immunity of children to scarlet fever and diphtheria. A similar principle has been utilized by Kauffer, of New York, who has had considerable success in determining the propriety of treating infected pulpless teeth by making skin tests with suspensions of dead bacteria recovered from the culture of the teeth in question. He has apparently demonstrated that, in many instances, the body is capable of coping with the organisms in such teeth when adequate local antiseptic treatment is given.

One of the commonly held beliefs of dentists as regards pulp canal operations is that when infection is already present, it is unnecessary to observe the strict aseptic precautions which are accepted as requisite in treating the noninfected tooth. Surgical principles and clinical observation both indicate the fallacy of this concept.

Operations in the already infected field must be as closely guarded as are operations involving the cleansing and filling of the presumably noninfected canal. By observing this principle, the operator will save himself the embarrassment of occasional acute flareups or of a long drawn out series of treatments. To accomplish the desired results, it is necessary then to adopt a standardized procedure whose objective is not merely the exclusion of foreign bacteria during the operation, but also the elimination of those bacteria already domesticated in the tooth or its periapical surrounding tissue. Since this paper is to concern itself with the possible value of bacterial cultures in pulp-canal therapy, I shall make no effort to outline the technic of treatment.

Assuming that bacteria are present in a tooth when treatment is undertaken, a question of considerable importance is that of determining when and if they have been eliminated.

It is obvious that the only positive test as to this is a culture taken from the canal or from the periapical region. It would seem to be obvious that this test should be made at least in all cases wherein infection is supposed to have been present when treatment was begun. What

I propose to discuss is the value and also the feasibility of such cultures.

First, let us consider whether the results of pulp canal culturing are infallible. In other words, does a negative culture give assurance of the absence of viable organisms? I think we may safely answer this question in the negative. Since we cannot remove the entire tooth and place it in our culture medium, we must depend on the picking up of organisms by a pulp-canal instrument, by aspiration or by placing in the canal an absorbent point saturated with culture medium. Any of these procedures must be considered as subject to a high degree of error, with the result that the test may be negative even when living organisms are present in the tooth or periapical region. It is of course true that positive results indicate the presence of bacteria and point to the need for further treatment.

What we must consider, then, is whether, on the basis of clinical results in culturing pulp-canal cases, the application of this procedure leads to definitely increased success in this field. Before attempting to answer this question, let us consider the types of examinations which may be employed for this purpose. The first type (a) includes the use of smears only. A second type (b) adds to the examination of smears the inoculation of culture medium with a standard period of incubation, for instance forty-eight hours. The next type (c) would involve, in addition to the foregoing, subculturing on different mediums under both aerobic and anaerobic conditions.

Our first question regards the adequacy of the types of examinations proposed. A very slight consideration will indicate that type a will reveal the presence of organisms in cases of gross infection only. If found to be negative, it gives no information as to the presence of slight amounts of infection. Type b is an improvement on this, but here much depends on the suitability of the medium employed for growing the variety of bacteria which may be present. Since this cannot be accurately forecast, it is clear that this type of examination will, in many cases, fail to reveal the presence of viable organisms. We come then to type c, in which provision is made for securing the growth in the culture medium of any organisms which may be present, assuming that they have been recovered from the canal.

If types a and b are inadequate, as I believe I have sufficiently indicated, are we justified in using them routinely? The answer is undeniably "no." The occurrence of negative results will, in too many cases, be a source of unwarranted satisfaction to the operator and of danger to the patient. Coming to type c, then, as the only adequate procedure, we are confronted with the element of expense, which is so considerable as to very nearly exclude it from practical consideration. In addition to this, we must recall the possibility that we may be unable to recover, for the purpose of culturing, organisms actually present.

By way of illustrating the acceptability of the points that I have made, let me cite the experience we have had in the department of pulp-canal therapy at New York University. Cases in which there was a reasonable certainty of infection were cultured both by commercial laboratories and in the department of bacteriology of the New York University Medical School. Commercial laboratory cultures were simple 48-hour incubations in standard mediums. The procedure in the university laboratory was subculturing for seventy-two hours in brain broth and in blood serum mediums. Reports from the commercial laboratory on presumably infected cases were often nega-

tive; while, on the same teeth, reports from the university laboratory were positive. Other cases of supposedly noninfected teeth were also cultured to provide a check both on the condition and on the pulp canal technic. These cases were negative by both procedures.

The importance of a thorough-going bacterial culture procedure in this field having been indicated, if it is proposed to utilize this test it remains to consider whether such an examination is actually requisite. The indications derived from cases so far studied are that by careful selection of cases and a rigidly controlled technic, the results of pulp-canal therapy may be adequately forecast. In other words, if only those teeth are selected for treatment in which there is reasonable expectation that infection can be eliminated, and if the technic of treatment is carried out with due attention to all aseptic precautions, the dentist may be assured that he has actually eliminated all bacteria from the field of operation.

It must be admitted, of course, that there is an element of uncertainty in the program just described. This is due chiefly to the fact that even the most elaborate bacteriologic examination may fail to disclose the presence of bacteria owing to failure to recover them from the canal when the primary inoculation is made. Such failure, of course, invalidates the most careful and protracted bacteriologic culturing, but if this method of examination is carried out on a large number of cases and by many different operators with careful correlation of bacteriologic and preliminary diagnostic findings, a standardization both of diagnosis and of pulp canal technic may be developed which will place pulp-canal therapy on a firm basis as a health measure.

IMPRESSIONS FOR DENTURES*

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THE lack of a standard by which impressions may be judged is a severe handicap in determining the merit of claims made for the several technics now being used. If I say that a particular technic will yield excellent results, I create in the mind of each hearer a picture of his conception of an excellent result. If we could project on a screen the pictures formed in the minds of those comprising this audience, we would probably find that there were as many different pictures as I have hearers. Each picture is the result of the hearer's personal experience, plus perhaps a good sprinkling of imagination. If necessary fundamental facts are not known to every hearer, the pictures cannot be the same. Perhaps we shall arrive at a more accurate conception of what an impression should be if we first study (1) the purpose of an impression; (2) the structures and reaction of the tissues of which we take impressions, and (3) possible measures for rendering the impression procedure so consistently uniform in es-

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sential details that variations in procedure will not, as in the past, confuse judgment of results.

An impression is taken in preparation for the construction of a base on which to fix artificial teeth, and, if we include partial dentures, to carry attachments of various kinds which hold the base in functioning relation to natural teeth that may be present.

When the teeth attached to the denture base are functioning, the stresses applied to the mandible by the action of the musculature of the masticating apparatus are transmitted to the denture base area or to this area and to the abutment teeth, first by the resistance of the bolus, and later by the resistance of the teeth themselves coming in contact on passing through the bolus. It is of prime importance, then, from the viewpoint of efficiency and comfort, that the denture base be seated evenly on as much surface as possible; evenly, in order that trauma or tipping of the base may be minimized, and over as much area as possible, in order that the force, being widely absorbed, will have less tendency to traumatize the tissues lying between the bone and the denture base. The immediate result of even pressure, widely distributed, is the preservation of the integrity of the tissues affected to the greatest degree consistent with the many natural limitations due to individual variations of relation, size and vitality index of denture base areas.

The composition of the so-called mucosa, covering the maxillary and mandibular denture base areas, is most complex. Its functions are many, as indicated by the structures found therein and disclosed by the studies of Pendleton and Kronfeld.[1] First, we find the outer protective layer, or epithelium. Underlying this, and joining it to the bone, is a framework of connective tissue, through which are distributed hundreds of minute glands, organs of circulation and of inner-

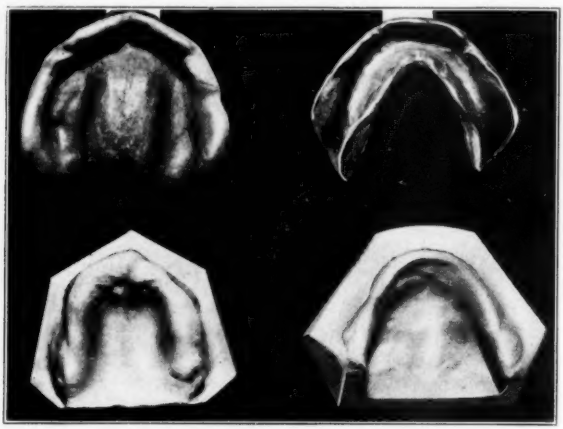

Fig. 1.—Snap impressions of maxillary and mandibular ridges, with study casts ready for preparing tray patterns.

1. Pendleton, E. C.: Positive Pressure Technique of Impression Taking, D. Cosmos, 73: 1045 (Nov.) 1931.

vation, as well as their accompanying protective masses of fat. This is a brief sketch, applying particularly to the maxillary denture base area, as, at this writing, the study of the mandibular denture base area is not completed.

It must be immediately obvious that there is no evidence in nature that glandular vascular and nerve tissues are intended to receive and resist the application of stresses such as are set up in mastication. This fact leads to the conclusion that the tissues against which dentures rest are not well adapted to the amount of connective tissue and the least number of other structures. It is to this area that as much as possible of the stress of mastication should be referred. Pendleton refers to it as the primary stress-bearing area. A second area of somewhat similar structure is the hard median palate area. Perhaps future experiments will prove that universal arbitrary relief of this median hard area of the palate has been a mistake. It now seems probable that it might be advantageous to use this area for resisting masticatory stress to some degree also. Several cases have been

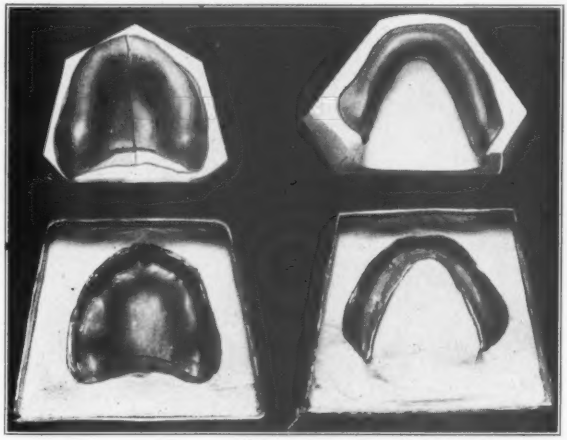

Fig. 2.—Upper and lower wax patterns on study casts. Only half of the topmost or tray layer of wax is shown on the maxillary cast to emphasize the presence of two layers (space provider and tray pattern) of wax, as well as the shortness of the space provider layer in the postdam area. Below: Tray patterns imbedded to periphery in soft plaster, retained in a box of sheet lead. When the plaster is set, the space provider wax is removed and the top section of two-piece mold poured.

purpose for which we use them. Therefore, since it is necessary to utilize them, we should be as cautious in going about it as intelligent observation and care will permit.

That part of the denture base area in the immediate vicinity from which the teeth were removed shows the greatest benefited by such procedure in my hands.

A common fault in our attitude toward denture technic is our failure to recognize the biocentric concept of denture function as related to changes in the tissues that we utilize. This concept, as applied to dental operations, recognizes that all living tissues are affected by the

introduction of unusual conditions into their environment.

The common changes produced by dental appliances are atrophic or hypertrophic. Atrophic, or more or less slow wasting change, is the most common tissue change met with dentally. All dental appliances, dentures especially, even when skilfully made, probably produce a condition that requires readjustment of the balance of the entire masticating apparatus. When appliances are carelessly or unintelligently made, the tions that cause them to interfere with normal circulation or if they do not make contact with the tissues under them equally except where we afford relief, either rapid tissue destruction or slower atrophy may occur.

The capacity of a tissue to resist unusual environmental conditions depends (1) on the age (hence, the vitality of the tissue); (2) on trauma or whether the new environment produces a condition which causes cell disintegration or death and (3), in the case of denture support-

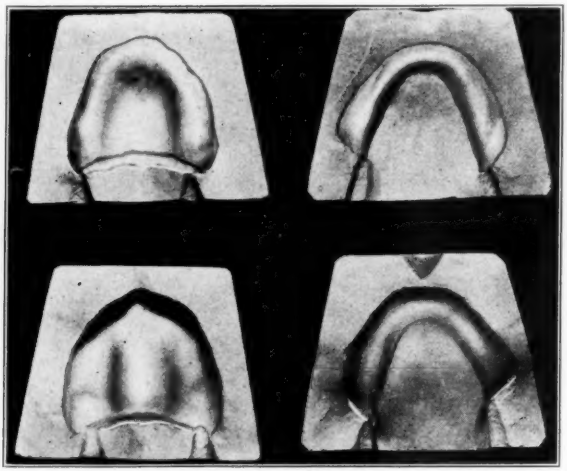

Fig. 3.—Two-piece tray molds opened, with gates and vents cut at heel. These pieces are dusted with lycopodium, heated moderately and clamped together, and fusible metal, similar to Dee's H or Engstrom metal, poured into the molds.

change not only involves readjustment but progresses beyond this to destruction of tissue. When fitting appliances to living tissue, we must know that the presence of these appliances under any condition sets up change in the living structures associated with them, and that these changes may be decidedly destructive if our planning and procedure is careless.

If impressions are made under conditing tissues, on the possible presence in the tissues of malign objects.

Age, disease and malnutrition are vital factors in lowering the capacity of the tissues of the denture base area to stand up under the new usage to which we put them. A rather poor, empiric technic may have an apparently satisfactory result if applied to a young patient about to turn, or just turned, adult. The same technic would be disappointing in an in-

dividual of lowered vital reactions, approaching, or in the state of senescence. In senescence, with disease present, we have the most unstable tissue condition possible. The kind of disease the patient is host to has much to do with the result; but unless we are dealing with young, healthy tissue, we cannot promise a very lengthy period of proper denture service, regardless of the type of impression technic employed. The technic that will yield the most nearly permanent result, when we are dealing with senescence or disease, or both, should produce comparably more lasting results for the young, healthy patient.

The words "proper denture service" are employed with particular reference to the preservation of the vertical dimension of the lower third of the face. This implies that comfortable function is not the sole criterion by which denture service should be judged.

Trauma in impression technic may be, among other things, produced by an unequal thickness of impression materials in the impression tray or by uneven consistency throughout the mass of the impression material when applied to the tissues for impression making.

To produce uniform results, impression trays should provide a uniform chamber for an even layer of impression material. Especially does this apply to the ridge areas. The impression material should be so prepared and manipulated that it will always be applied at the same consistency.

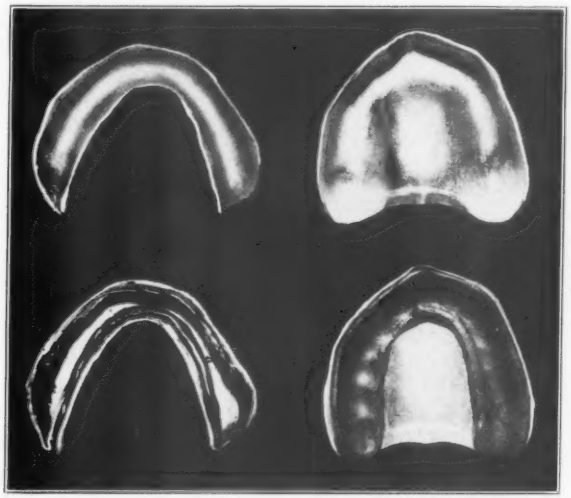

Fig. 4.—Trays finished (above) and trays with compound applied (below) ready to be immersed in water bath of a thermostatically controlled heater; temperature, about 135 F.; time, long enough to thoroughly plasticize the compound (from one to three minutes).

In dealing with plaster or plaster compounds, the proportions of water to powder must always be definitely the same and the mixing procedure should always be uniform as to time and method.

Thermoplastic materials, like modeling compound and rebasing wax, should be carefully checked in manufacture to pro-

vide uniform plasticity, flow and hardening time at a particular working temperature. In heating these materials, an accurate thermostatically controlled water bath is a real necessity for consistent results in technic. Thermoplastic materials cannot be used to the best advantage by the old rule of thumb methods. To be sure, they can be worked by any of the old methods, but with such variation between successive impression operations that the operator is deprived of the definite knowledge necessary to check and improve his technic.

Fig. 5.—Thermostatically controlled water bath heater, with removable pan, for containing water in which compound is heated. The temperature of water can be controlled to within plus or minus one degree all day. The temperature reading on the thermometer should determine the position of the control lever as the scale may not coincide with the thermometer, owing to voltage variations. Such a heater is also useful in rebasing with either compound or wax.

The elimination of foreign objects from the denture base area should be conservatively and thoroughly effected, if possible without decreasing the size of the denture base area, especially the width of the upper ridge. "Foreign objects" is here used to indicate roots, fragments, infected tissue or even, on rare occasion, portions of filling material left in the alveolar socket after extraction. A roentgen-ray survey of the edentulous ridges should always precede impression making for patients of which one has no records. All inflamed tissues should be reduced to a normal state of color and health before impression taking. This can be promoted by the removal of old dentures, the use of antiseptic washes and, occasionally, the administration of from 3 to 5 drops of viosterol three times a day at meals, with milk and orange juice; or other necessary medical treatment.

The periphery of the impression should not project into the field of activity of muscles bordering denture base areas. The natural action of the muscles will produce either local trauma or displacement of the denture. A thorough impression technic will incorporate provision for avoiding overextension of the margins of the denture base. When fibroconnective cords of frenums arise from the borders of the denture base area, a proper examination of the mouth should disclose them. A good impression technic will provide space for such structures and will not displace them.

The choice of an impression material may be influenced by the relative density of the soft tissues covering the denture base area. Plaster compounds or impression plaster are ideal for impressions of hard objects, such as the teeth or a denture base area overlaid by a thin, dense mucosa. It is essential that they be retained in tissue contact during setting. Also, these materials must be used in a tray

the periphery of which closely approximates the peripheral outline form desired in the finished impression. When the mucosa is relatively thick and soft, or of average consistency, modeling compound alone is the material of choice. Also, when hard and excessively soft areas irregularly associated are to be dealt with, modeling compound should be used. The method followed here is to develop the imprint of the hard parts of the ridge and vault first, in regular compound, and after this operation, to take the imprint of the soft tissue areas in either of the two low fusing compounds, green or black. A more stable impression or denture will be developed by this plan than when the commonly recommended opposite method of compressing the soft tissues by confining them under pressure is employed.

In developing the periphery of maxillary full denture impressions of modeling compound, a very satisfactory method is to trim the periphery by lip or cheek movement while the impression is held in place under so-called "biting stress" and the patient, by a swallowing action, creates a vacuum in the mouth. For this plan, the closing pressure should be directed to the molar bicuspid area and not to the incisor region. Also, the force of closure should be bilateral and equal. If the patient cannot be depended on to cooperate in this particular, knife trimming of the periphery, or muscle trimming while the impression is held *in situ* by finger pressure, is preferable. One who understands mouth anatomy can develop a very satisfactory peripheral outline for any impression by "knife trimming." This is most frequently the

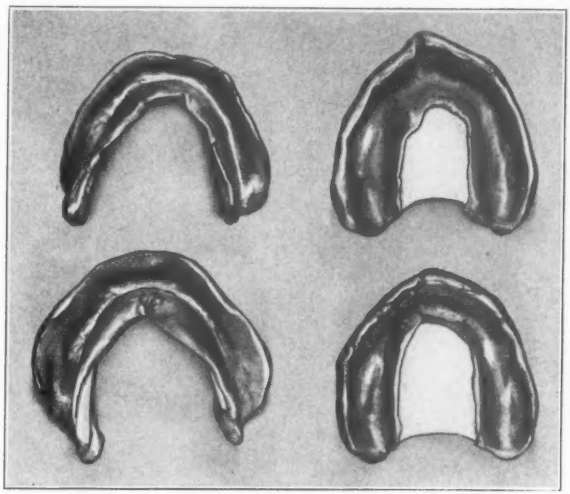

Fig. 6.—Maxillary and mandibular base impressions, preliminary stage (top). The palate of the maxillary impression is incomplete, permitting easier seating of this impression mass with less distortion. Below, right, maxillary impression with muscle trimmed periphery. Below, left, mandibular impression made with single roll of compound applied in trough of tray. Above, left, mandibular impression, made with compound applied as in Figure 4.

case in finishing the margins of mandibular impressions or in the buccal margins of partial saddles of upper impressions and both buccal and lingual margins of lower partial saddles.

No matter what one's choice of impression materials may be, a vital part of the sequence of operations is the preparation of an impression tray. The tray should be rigid and enough oversize to provide a uniform space between tray and tissue, for the desired thickness of impression material. Manufactured trays, though available in great variety, rarely meet the requirements of contour and outline form to avoid tissue distortion or displacement. This being the case, one has to resort either to the use of modeling compound as a tray for plaster impressions or construct a special tray of metal if he intends to complete the impression in compound or wax.

The Engstrom cast metal individual impression tray is made in a two-piece plaster mold and is cast in low fusing tray metal, such as Engstrom or Hooper metal, which is rigid and fuses below 190 F.

The method of constructing these trays is simple. First, we need a study cast, which is made from an ordinary modeling compound snap impression. On the study cast, a layer of baseplate wax is adapted and cut to the approximate outline form desired for the finished impression. In case of doubt, this wax form should be made large rather than too small. Oversize can be corrected by

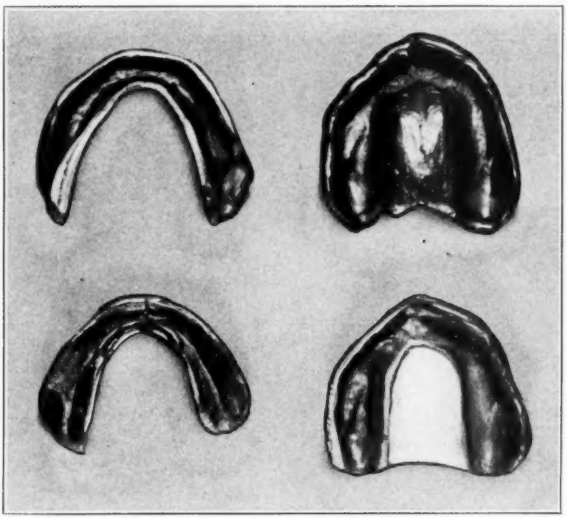

Fig. 7.—Above, left, mandibular impression knife trimmed. Above, right, maxillary impression after muscle trimming, following completion of palate under pressure of closure. Below, left, mandibular impression showing right heel corrected by tracing (last stage); tracing flattened out, right lingual flange bicuspid molar section (second stage); tracing as applied from warm tracing stick, lingual incisor region (first stage). Below, right, maxillary impression showing left periphery cut away to add excess of green or black compound for muscle trimming, also right periphery after trimming by muscle action.

fitting and trimming at the chair. Talcum powder or lycopodium is dusted on top of this layer of wax and on it a second layer of the same form and size is formed. A little quick setting plaster is smeared on top of this second layer of wax to give it rigidity.

A brass, lead or cardboard form of the proper outline for a tray mold is laid on the bench and filled to a depth of about three-fourths inch with plaster of Paris. The two layers of wax are lifted off the study cast and imbedded up to the periphery, plastered side down, in the soft plaster. When the plaster is trimmed even with the peripheral outline of the wax pattern, after removal of the retaining form, the uppermost layer of wax, which was used only to insure the actual tray pattern's being enough larger or oversize to provide for a thin layer of impression material, is removed. The metal form is replaced on the section of the plaster mold, the exposed plaster soaped and the second half of the mold poured. The two halves, when set, are separated, the wax removed and a gate and a vent is cut in the heel of the mold, which is coated with lycopodium. The mold halves are set over a low flame until uncomfortably warm to the touch. The sections are then clamped or tied together, and the tray metal is melted and poured into the mold. The procedure is fundamentally the same for either upper or lower or for partial dentures. In forming the first layer of wax for a full upper or a partial denture extending to the soft palate, it is usually better to cut the palatal border of this space provider a little short to effect a closer fit of the actual full length tray to the postdam area of the palate. This controls posterior escape of the impression material,

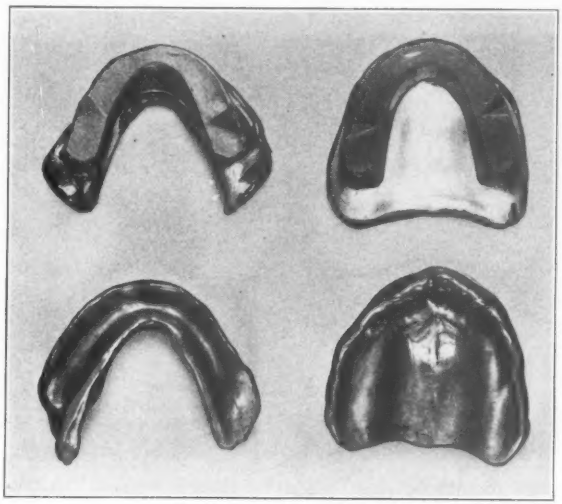

Fig. 8.—Maxillary and mandibular impressions with occlusion rims added to facilitate trimming of periphery by muscle action under pressure of closure (above); maxillary and mandibular impressions completed; tuberosity and buccal retromolar regions trimmed under closure pressure and swallowing action.

should plaster be used, and provides for a closer adaptation of the impression to this region. This technic produces a tray with a uniform clearance for impression material. By trimming the trays to clear the buccal and labial muscles by about 2 mm., provision is made for easy finishing of the periphery without tray interference.

Care should be exercised not to trim the lingual flange of the lower too short. It may even be overextended a little, except in the linguo-incisor region. The upper tray should extend well up into the free space between the tuberosities and the cheek, and backward in the vault, to the line of tissue deflection, at the termination of the immobile hard palate tissues. More upper impressions are ruined by having insufficient length in the palate and not having sufficient height and length in the tuberosity region than from any other cause.

The buccal and labial margins of either tray should be short enough to permit pulling upward, or downward, as the case may require, on the lip or cheek muscle grasped between the thumb and finger without displacing the tray. The tray is held lightly in position.

In employing modeling compound for impressions, we should remember that the initial steps for each impression should produce an overextended periphery, to be later corrected.

THE LOWER IMPRESSION

For narrow lower ridges, we trace a small roll of compound into the ridge depression of the tray; for wider ridges, a small roll of compound on the buccal labial and lingual flanges midway between the edge of the flange and the ridge crest area.

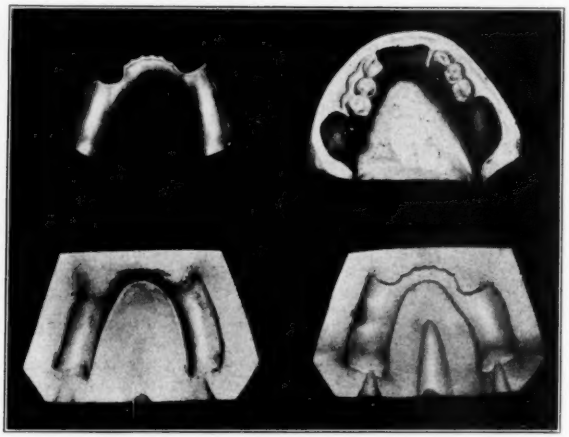

Fig. 9.—Tray mold and tray for partial lingual bar lower and (above, right) wax tray pattern preparation for difficult partial mandibular impression.

The tray is placed in the thermostatically controlled water bath at 135 to 140 F. for one minute, and seated in the mouth, with equal finger pressure on the right and left molar-bicuspid regions. If insufficient compound was used to completely cover the tray, we either clean the tray and repeat the process from the beginning or build in the defects by adding

tracing compound; then rewarm in the heater and reseat the tray.

If it is desired to muscle trim the impressions under pressure of mandibular closure, we place an occlusal rim on the mandibular tray and flatten it out to approximate the direction and elevation of the plane of occlusion. After proceeding with the upper impression up to the muscle trimming stage, we add an occlusal rim of soft compound to it also. Under closing pressure, we register the imprint of the mandibular rim in the soft maxillary rim just added, and chill and trim

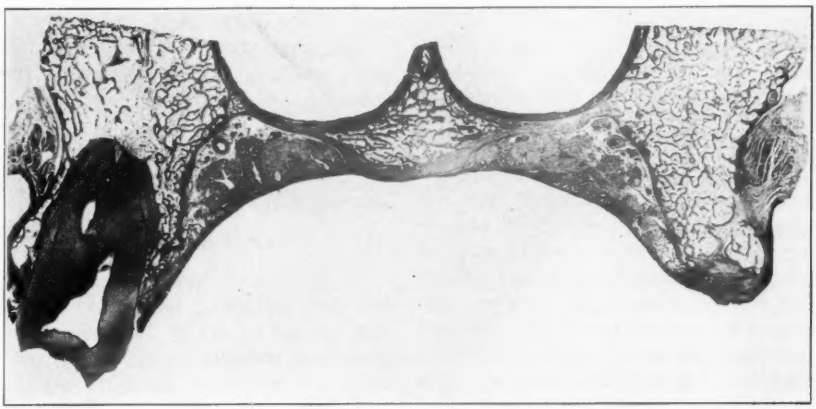

Fig. 10.—Section of maxillary arch through molar region, showing *A*, triangular soft tissue area with vascular, nerve, gland and other structures. *C*, hard area of median palate. Scar tissue is evident at the crest of the ridge. The comparatively small area of hard tissue is suited to resisting stress of mastication. (E. C. Pendleton.)

the rims to approximate the width dimension of the teeth they substitute for.

FINISHING THE LOWER IMPRESSION

The peripheral one-eighth inch of one buccal flange is warmed with the blowpipe flame, and the heated section is immersed for two seconds in hot water and the impressions are seated in the mouth. The patient is asked to close and swallow forcibly. The upper impression is, of course, in place in the mouth. We repeat this procedure for the opposite buccal and labial sections. The peripheral edge of the posterior third of one lingual flange is warmed in the same way and the procedure followed as before, being repeated for the opposite side. The trimming of the remaining margins of the impression may be effected either as just described or by knife trimming.

Knife trimming is often the better plan. We trim to the level of the adjacent muscle attachment and the mylohyoid ridge. When in doubt, it is best to finish the impression slightly oversize, and relieve any consequent soreness by trimming the finished denture. Do not fail to extend the lower impression far enough to cover the retromolar region of the mandibular ridge.

THE UPPER IMPRESSION

In making the upper impression, we place the compound in the upper tray in the ridge area of the tray only. The

tray is then returned to the heater for one minute, with the water at from 135 to 140 F. The tray is removed, placed in position in the mouth and seated, with upward pressure applied in the center of the vault of the tray. When it is seated, pressure is discontinued, and the tray is merely supported, with just enough resistance to prevent its dropping from position, to avoid continued flow and distortion. It is then chilled to hardness with cold, wet gauze napkins, and removed.

At this stage, a bite or occlusion rim may be added, if it is desired to form or muscle trim the periphery under bilateral, equal closing pressure of the mandible. The peripheral margins are heated by means of the blowpipe until glazed and soft, then tempered in the hot water bath, and the impression reseated in position under closing pressure. The patient is caused to close firmly, swallow several times and then protrude and retract the lips several times to free the warmed periphery by pushing it out of the zone of action of the adjacent muscles. The impression periphery is warmed and trimmed one third at a time, the right and left buccolabial first, and then the labial. Soft black or green compound is now added in the central palate portion of the tray, so far uncovered. This is warmed with the blowpipe to flowing consistency, touched to the hot water and the impression reseated in the mouth under pressure of mandibular closure or finger pressure. This operation should fill the vault and join the vault surface smoothly to the impression of the ridges. If too much compound has been placed in the palate area, the excess may be trimmed away with a sharp knife, the palate reheated and the seating repeated as may be necessary. Too small a quantity of material added to the palate may require the addition of a slight amount of material, rewarming and reseating.

Next, the excess is trimmed off the posterior edge of the palate of the impression, and this edge is stained by drawing the moist lead of a soft indelible pencil across it. Seating the impression should transfer a line to the palate. The impression is the right length if this line is located at the junction of the mobile soft palate with the hard palate proper. If too long, the line will be on tissue that lifts when the patient sounds "ah," or, to reverse it, on tissue that bulges downward when the nostrils are pinched shut and the patient forces air into the nasal cavity under slight pressure.

The notch for the frenum may require warming to permit drawing the upper lip down to free the frenum from pressure. Do not forget to dip the warmed section of the impression into the hot water bath before placing the impression in the mouth.

PARTIAL IMPRESSIONS

In this type of case, a combination of modeling compound, finished off with a thin coating of one of the plaster compounds, is sometimes used for convenience. A compound primary imprint, limited to the actual outline of the saddle, or saddle and bar areas, to be covered by the finished denture, is first made. A plaster compound coating is applied over the entire saddle bar area. When seated, this will escape off the compound onto the uncovered central portion of the tray. When set, this plaster coating holds the impression in position while a secondary impression of the remaining teeth is made. The imprints of the abutment teeth and adjacent parts of the metal tray are made either with plaster in split trays or of plaster laid on with a spatula in several separate sections. The plaster is applied to cover part of the metal tray as well as the teeth. These

secondary plaster impressions may be broken away, and the tray carrying the soft tissue bearing part of the impression removed last. The advantage of this technic is accuracy in relation and assembling, and ease of removing the parts of the impression. The principal advantage is that the thin plaster compound applied to the primary impression of modeling compound holds the impression of the soft tissue areas in place, while the tooth-including, secondary impressions are developed.

FULL DENTURE IMPRESSIONS WITH PLASTER OR PLASTER COMPOUND FINISH

The procedure for this method of completing impressions is similiar to that employed for partial impressions.

The primary ridge, or stress-bearing area of the upper impression is completed in compound as for the full compound technic. A postdam is also added in compound. The periphery is formed to accommodate muscle movement and then relieved evenly by knife trimming to about 1.5 mm. over the tuberosities and from 2 to 2.5 mm. for the remaining peripheral margin. This allows for finishing these margins in the plaster or plaster compound. Four holes are drilled through the metal tray with a No. 8 round bur, in the second molar and cuspid regions, about midway between the median line and the crest of the ridge. The plaster compound is applied to the compound of the stress-bearing area in sufficient quantity to fill the voids at the periphery and central palate areas, when it escapes off the compound as the tray is seated, preferably under closing pressure.

The lower impression is taken by adding a rim of compound to the peripheral margin of the tray, leaving the ridge crest area bare. This is trimmed to the desired peripheral outline. Holes are drilled in the crest of the ridge area of the tray in the first molar and cuspid regions. The plaster compound is added to the valley of the tray and escapes buccally and lingually as the tray is seated, preferably under stress of closure.

I particularly wish to recommend to you the study of the writings of C. J. Stansbery on negative pressure, and the writings of E. C. Pendleton. They apply practically the same principles as I have outlined, but differ in that they do not use the individual tray, as well as in other minor details.

The individual tray is preferred because it permits confining the impression mass against the tissues in an even layer, and also permits warming the compound and tray to the working consistency of the compound employed.

The full compound impression is usually to be preferred, because it allows developing a nearly functional compression of moderately soft areas; because it can be modified or corrected by stages and tested by additions or local tracing; and because of the patients' favorable reaction toward a waxlike substance as compared to their aversion and fear of plaster.

The compounds that I have come to prefer are Kerr regular, green, and black; and for finishing impressions with a plaster compound, I prefer "truplastic," because of its ready flow and tendency to adhere to the tray even in very thin layers.

In practically all fields of dental operation, speed is a lure irresistible. Speed that accomplishes something is the result of skill acquired by practice. This is to be sought after; but speed for its own sake is to be frowned on. This is as true of impression making as it is of other phases of dentistry. If it is realized that the impression furnishes the foundation on which the denture superstructure is reared, it will be a

perfectly sane conclusion that any time devoted to making an accurate, tested impression, suited to the needs of the purpose for which it is to be employed, will be time well spent. I cannot bring myself to agree with that attitude of mind toward impression technic which starts with speed and ends with an incomplete result. The ultimate object of our impression technic is efficiency and comfort in the finished dentures. Even with the expenditure of all the time necessary to secure really good impressions in modeling compound or otherwise, this time is a relatively small item compared to the time consumed in completing the other operations that follow and are incidental to the building of really artistic and efficient artificial dentures. Is it not foolish, then, to jeopardize the value of succeeding operations by "short cutting" on the impression technic?

ONE HUNDRED YEARS OF DEVELOPMENT IN METALLURGY AND ITS RELATION TO ORTHODONTIA*

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UNTIL fifteen years ago, scientific metallurgy of dental materials was practically unknown. While a number of useful materials which have performed valuable service and which form the basis of many of our present materials had been developed prior to this time, there has been little systematic and scientific development of dental materials until recent years.

Since the practice of orthodontia has been intimately associated with the practice of general dentistry, the progress in the metallurgy of orthodontic appliances closely parallels that of the materials used in general dentistry. As this is particularly true of the period prior to 1900, when there were but few men who practiced orthodontia exclusively, it is natural that the same materials that were used to construct bridges and dentures were used in the construction of orthodontic appliances for many years.

Dental literature is extremely meager as regards exact information concerning the materials used in the practice of orthodontia. The statement that an appliance is constructed of gold and platinum or silver hardly describes the material from a metallurgic standpoint. And yet, in most instances, that is the only description of the material that is given, even in the current literature.

During the first half of the past century, a large portion of the precious metals used for dental purposes was supplied by the local jewelers and silversmiths, with consequent wide variation in composition and properties. In general, the alloys supplied were the regular 16 to 24 carat gold-silver-copper alloys and sterling silver commonly used for jewelry purposes. The development of precious metal alloys for strictly dental purposes by dental manufacturers began toward the close of the nineteenth century. The

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formulas for these alloys are, supposedly, trade secrets, and some manufacturers are reluctant to furnish any definite information whatsoever concerning their products, in spite of the fact that no metallic alloy has ever been made whose composition and properties could not be determined by modern methods. Not until the recent work of the Research Commission of the American Dental Association in conjunction with the National Bureau of Standards has it been possible to obtain more definite information concerning the properties of dental alloys than in such terms as extra tough, hard or extra hard and very elastic. Dentists are beginning to appreciate the value of selecting their materials on the basis of the physical properties, measured by scientific methods, and are requiring the manufacturer to furnish accurate and definite information. Dental materials will be markedly improved in quality when this practice becomes universal.

A review of the developments or changes that have taken place in materials used for the construction of orthodontic appliances clearly indicates that the design of orthodontic appliances and the method of treatment have, in the past, been determined by the materials that were available at the time the appliance was developed. It is also evident that orthodontic appliances can be divided into two general groups or types, based upon their construction and action: (1) the rigid type and (2) the flexible or resilient type.

The rigid type, as the name implies, has a definite or fixed form which can be modified by the operator, but which does not change shape appreciably in the mouth, tooth movement being produced by drawing the tooth toward the appliance by means of ligatures or screws or by pushing the tooth away from the appliance by means of wedges, screws or springs. A typical example of this group is the jackscrew. Rigid appliances have been used from the very beginning of orthodontia to the present day.

Practically every material that has been used in dentistry has been employed in the construction of the rigid type of appliance. From the time of Fauchard (1726) till 1850, the appliances were constructed chiefly of gold or silver and were of the expansion arch type or swaged palatal bases. The invention of the rubber vulcanization process in 1839 and its adaptation for dental purposes in 1850 introduced a material which soon found wide use in the construction of appliances. It was first used in the same manner as the swaged metal bases, but as new means of applying force to the teeth were developed, it was used in conjunction with other metals, particularly the base metals such as brass and steel, which could not be soldered. Piano wire was first demonstrated in this country by Coffin in 1865, in combination with vulcanite. The development of various types of plain and anchor bands, about this time, which offered superior anchorage for the appliance relegated vulcanite to a position of minor importance. Vulcanite is still used in certain types of retaining appliances, its use thus extending over a period of eighty years.

The introduction of nickel silver alloys by Angle in 1887 in the form of standardized or manufactured appliances was unquestionably the outstanding achievement in regulating appliances during the nineteenth century. The material was far superior in elastic properties to any of the metallic alloys previously used, and the use of standardized appliances not only simplified the construction of appliances, but also made available to all practitioners a simple, efficient mechanism of uniform quality and working properties. The expansion or E arch in-

troduced by Angle, together with many of the present expansion arches of similar construction, is classed with the rigid type for the reason that, while these arches have a certain amount of resiliency in their lateral dimension, short lengths of the wire are quite rigid, owing to the heavy gage of the wire used in their construction. The principal disadvantage of nickel silver arch wires is that they must be used in the hard drawn state since a large portion of the tensile strength and resiliency of the wire is obtained during the drawing of the wire. When the work hardening effect is removed by heating the wire to a red heat, as during soldering, the wire becomes soft and loses its resiliency. The original condition cannot be restored by heat treatment as is possible with some of our present alloys. This necessitates the use of larger gage wires with consequent loss in flexibility and extreme care in soldering.

The development of the high strength, complex alloys of gold, platinum, silver and copper for denture clasps, around 1900, presented a new material to the orthodontists. The use of these new alloys was, at first, rather limited, owing to the wide popularity and low cost of the nickel silver alloys, but the development of smaller and more delicate appliances made necessary the use of stronger and more elastic alloys. In the seventh edition of "Malocclusion of the Teeth," published in 1907, Dr. Angle says "The oft repeated fallacy that gold is the one suitable metal for the construction of regulating appliances is rapidly passing, as it ought, for undoubtedly it has been a real hindrance to progress." In 1912, he agreed to the use of precious metal alloys in the construction of the 0.030 inch pin and tube appliance, and all subsequent Angle appliances have been constructed of noble metal alloys. In my estimation, the 0.030 pin and tube appliance was the first truly resilient appliance reported in the literature, its size and construction being such that every section of the arch could be made to exert a continuous force.

The high strength elastic gold alloys have played a most important part in the development of orthodontic appliances and treatment that has taken place in the past thirty years. Many of the present appliances and technics could not have been developed without their use.

The composition of the noble metal alloys used for orthodontic purposes varies between wide limits. They are essentially alloys of gold, platinum, silver and copper, with small amounts of other metals. As a matter of fact, the actual composition of the alloys is of minor importance to the orthodontist; a knowledge and correct interpretation of the physical properties of these alloys are important.

The science of orthodontia is comparatively new, and its problems are many. The relationship of the metabolism and development of the dental arches to the rest of the body, the problems of etiology and diagnosis, muscle function and habits, are complex and often difficult to solve. They require training and intelligent thought. Nevertheless, in most cases, the correction of malocclusion requires the use of a metallic appliance to produce tooth movement. Isn't it logical, then, that the orthodontist should have some understanding of the properties of the materials he uses, that he may perform his operations more efficiently?

Unquestionably, there is an optimum force or stress, which, applied to a tooth, will produce maximum movement within the limits of physiologic tissue reaction. What are the characteristics and magnitude of that force? As far as I know, no one can answer that question. Further, I believe that there are few orthodontists

who would venture to estimate with any degree of accuracy the amount of force that they are applying in the treatment of their cases. Only scientifically conducted research will reveal the answer. When the force that should be applied has been determined, it will be a much simpler problem for the metallurgist to produce an alloy that is capable of producing that force and then design a mechanical appliance that will produce the desired force. The histologic research concerning tissue reactions subsequent to tooth movement that has been carried out in experimental animals is less valuable than it might have been if the forces applied had been accurately measured and controlled.

The properties of the appliances and wires used in orthodontia show wide variations due to (1) differences in chemical composition, (2) differences in processing or manufacturing the wire, (3) the effect of soldering, (4) the effect of stressing the metal beyond the elastic limit in contouring the wire, (5) the susceptibility of the alloys to heat treatment and (6) the effect of repeated stresses and age hardening which the metal undergoes while in the mouth. Even in a single arch wire, there may be marked differences due to the operations performed on the wire. The orthodontist should understand and appreciate all the conditions which tend to produce differences in the properties of the metals that he uses.

The Research Commission of the American Dental Association and the Bureau of Standards have made a valuable contribution to dentistry in establishing methods of testing and setting up minimum specifications for dental materials. The dental profession has saved and will continue to save large sums of money by the elimination of inferior materials. Far more valuable has been the education of the dentist so that he can use his materials correctly and most effectively. The work of the Bureau of Standards on orthodontic wires is only a starting point. The properties of arch wires and the design of appliances should be more completely investigated and the results interpreted so that all may understand their significance and practical application. Some manufacturers are basing claims for superiority of their products upon higher proportional limit and ultimate strength values than that of their competitors. From an orthodontic standpoint, these values alone are no criteria of the value of a wire for the construction of an appliance. Nor is there any single method of testing or any single value which will adequately define the properties of a metallic alloy even though there may be a relationship between certain of the values.

It is necessary to know a series of values, obtained by standard methods, including composition, proportional limit, ultimate strength, modulus of elasticity, percentage of elongation and of reduction in area and Brinell hardness, in order to estimate the tensile or elastic properties of a metallic alloy. How many orthodontists understand the significance of each of these values and the relationship of each to the working qualities of the material that they use? When the profession can describe and purchase their materials in these terms, there will be a decided improvement in the quality of the material furnished by the manufacturer.

That heat treatment will affect the properties of the metallic alloys used in orthodontic appliances is known to many. The modification of the properties of wires by this method is practiced by few orthodontists. The value of correct heat treatment has not been adequately demonstrated to the profession to promote its more general use. Its chief value is the elimination of the effects of soldering and bending the wire beyond the propor-

tional limit, thus rendering the wire uniform throughout its length; although increased resiliency may be obtained by this process. Since different alloys respond to heat treatment in varying degrees, it is necessary to know the correct treatment for the particular alloy being used to secure the best results. Incorrect heat treatment of some alloys may produce an extremely brittle condition. Further research in the physical metallurgy of the complex dental gold alloys concerning the changes in the internal structure that take place during heating and cooling is necessary to clarify and simplify the process of heat treatment.

Several years ago, a new material, namely stainless steel, was introduced for use in orthodontic appliances. My experience with this material has been very limited, but I am of the opinion that its inferior tensile properties and difficulty in soldering will not compensate for its low cost and that its use will be limited to certain types of appliances.

In the past, many of the developments and improvements in dental materials were the work of dental manufacturers or of individuals in cooperation with manufacturers. Owing to the rather limited market for orthodontic materials and to the high cost of this type of investigation, only a limited amount of research in this field can be expected from the manufacturer. Dental colleges and orthodontic associations will have to sponsor the research problems suggested in this paper if genuine progress in the metallurgy of orthodontic materials is to be made.

SUMMARY

Orthodontia has, in the past, depended to a large extent on other branches of dentistry for its materials.

The progress in orthodontic treatment has been intimately associated with improvement in the materials used.

Orthodontists should have a better understanding of the nature and behavior of metallic alloys.

Extensive research in the physical metallury of orthodontic materials is necessary to continue the progress that has already been made.

PATHOLOGY AND PROTECTION OF THE DENTAL PULP IN PARTIAL DENTURE CONSTRUCTION*

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THAT a structure can be no sounder than its foundation is a common saying. While in dentistry this principle is obvious in the construction of fixed bridges, it is no less applicable to the construction of removable partial dentures. In either case, the value of the finished restoration may be nullified if the pulp in one of the supporting teeth becomes inflamed or necrotic; for, in the correction of such a condition, it may be necessary to reconstruct the entire partial denture. Furthermore, the tendency to let the restoration remain as it is, once it is completed, may lead to serious consequences if the pulp condition is neglected,

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The importance of protecting the pulps of all remaining normal teeth when a partial denture is to be constructed is therefore obvious.

The resistance of the pulp to destructive forces has been commonly recognized to be small, except in children's teeth with widely open foramina. The fact that the pulp is enclosed in a limited space and cannot expand, together with the fact that, in the apical region, the veins and arteries and nerves entering the pulp occupy almost the entire lumen of the pulp canal, has been offered as an explanation of the pulp's low resistance. When the pulp is irritated, the artery dilates, the blood supply to the pulp thus increasing. As long as the venous drainage is adequate, no harm is done; but if the arteries dilate so much as to constrict the veins in the apical region, the outflow of blood is inadequate, and increased pressure within the pulp, with consequent congestion and pain from pressure on the nerve, is the result. If this is of short duration and the blood vessels return to normal, the pulp will not be seriously involved, but when, through chronic irritation or very severe and sudden irritation, the blood vessel walls lose their tonus and fail to contract, the pulp may undergo congestion, degeneration, stasis or necrosis. Systemic conditions, which lower the ability of the blood vessels to react, also lower the resistance of the pulp to destructive forces.

Again, when the pulp becomes infected, for example, through the dentinal tubules, without being widely exposed, there can be no adequate surface drainage for inflammatory exudates such as a skin lesion affords. These facts explain the low resistance of the pulp to infection. Consequently, the hope that, by some special treatment, a diseased pulp canal may be made to return to normal is not supported by our present state of knowledge. We believe therefore that the successful control of protective treatment of the dental pulp requires that the pulp be in a nearly normal condition at the time treatment is started. The more involved pathologically the pulp becomes, the less favorable the prognosis.

Since the pathologically involved pulp does not always cause severe symptoms, but may behave for a considerable period of time much like a normal pulp, the importance of a correct diagnosis before treatment cannot be overstressed.

In diagnosing the condition of the dental pulp, we should consider the following: (1) the history of any pain; (2) the condition of the crown of the tooth clinically; (3) the response to electricity, heat and cold, and (4) the roentgenographic findings. One may also use transillumination, although we have not found it of particular value. The history of any pain is of great value in diagnosis. Sensitiveness to hot and cold fluids indicates hyperemia of the pulp, due often to exposed dentin. A severe, throbbing, continuous pain indicates an acute pulpitis, while occasional slight pains occurring without sudden irritation indicate chronic pulpitis. Cessation following a severe throbbing pain of several days' duration indicates stasis and death of the pulp. Tenderness of the tooth indicates inflammation of the periodontal membrane.

The condition of the crown shows the presence of cavities, abrasion, erosion, and exposure of the pulp. If large fillings are present in a questionable tooth, the roentgenogram may show that the filling reaches the pulp chamber, though care must be taken not to misinterpret a superimposed shadow such as is made by a gingival buccal filling.

The electrical test is chiefly of value in determining whether a pulp is vital. Variations due to the thickness of enamel

and dentin, to the presence of pits or fissures and to the irritability of the nerves of the pulp prevent determining with certainty the pathologic condition of a vital pulp by this test. Certain it is that a response to the electrical test does not necessarily indicate a normal pulp. In the making of electrical tests, large metal fillings or crowns must not be touched by the electrode, and porcelain crowns will not conduct the current.

In the making of cold thermal tests, ice is very convenient, although cold water or ethyl chloride spray may be used. For heat, guttapercha warmed over a flame or a red hot burnisher may be used, but care must be taken not to overheat the tooth. In general, application of very hot guttapercha for but an instant to the gingival third of the crown will give a reaction in the presence of a normal pulp. Cuspid and posterior teeth take a longer time to react than do incisors, in some cases the reaction being delayed as much as fifteen seconds. Metal fillings aid in the conduction of heat and cold. The reaction to ice occurs generally in from one to ten seconds, this depending on the thickness of the enamel and dentin. An unusually severe reaction to cold indicates hyperemia or beginning inflammation of the pulp, in which case heat may relieve. An unusually severe prolonged reaction to heat indicates passive hyperemia or advanced inflammation, and in this case cold may relieve. A negative response to heat or cold does not always indicate death of the pulp.

Roentgenograms show the proximity of caries and of fillings to the pulp. A close approach by either is sometimes a valuable clue, when obscure dental trouble must be located. Roentgenograms also show teeth with root-canal fillings and chronic periapical involvement. In this connection, it is well to remember that an infected vital pulp in a tooth showing no periapical involvement roentgenographically is often to be considered a more dangerous focus of infection than a pulpless tooth with a root-end involvement.

While in reality pulps may exist in all degrees of variation between a normal, healthy tissue and a necrotic infected mass, it is convenient for diagnostic purposes to divide the conditions into four groups, namely, the normal, the hyperemic, the inflamed and the necrotic pulps. Of these, we may divide the hyperemic pulps into the physiologic and the pathologic; the inflamed pulps, into the acute and the chronic. And all these conditions may involve only a part of the pulp.

Degenerative conditions in the pulp, as seen microscopically, have been studied in great detail. They occur in the teeth of people of all ages, but most commonly in the aged. Sometimes the degeneration is a sequel of infection, but often the cause is obscure. The common forms of degeneration recognized in the dental pulp are fibroid, hyaline, areolar and calcific. At present, we are not aware of a reliable means of differentiating these changes clinically and therefore they are not included in the classification of pulp conditions to be used for diagnostic purposes. Some of these cases of calcific degeneration are evidently due to a previous infection, and in such a case they have a protective significance.

1. The normal pulp will have a negative history as regards pain. The pulp will not be exposed (unless by accident during operative procedure), but will be covered by sound dentin. There will almost always be a response to electricity applied to the enamel, and a response to heated guttapercha and to ice. In making these tests, the thickness of the enamel and dentin should be used as a measure of the resistance of the tooth to the test. Roentgenographically, the pulp will not

show an exposure or an apical radiolucent area.

2. The hyperemic pulp gives a history of pain, generally when the patient has taken hot or cold liquids or breathed in cold air. This pain in physiologic hyperemia goes away in a few seconds. In pathologic hyperemia, it is of longer duration and more severe. The same is true of thermal tests. If the response to heat is severe and of several minutes' duration, the hyperemia is pathologic. In a pulp about to undergo stasis of its circulation, cold may relieve pain and heat produce a severe reaction. The pulp responds electrically. Clinically, there may be deep caries, a recent filling or abrasion. The roentgenogram shows no exposure and the periapical tissue is normal. The longer the duration and the greater the severity of pain following an irritation such as to the heat test, the less favorable the prognosis.

3. The inflamed pulp, when the condition is acute, will be painful with or without thermal irritation. A chronically inflamed pulp may have produced only slight symptoms. Generally, a deep cavity will be found with the pulp almost or completely exposed or covered by a large filling, which may show roentgenographically. The acutely inflamed pulp will respond mostly to heat, and the pain may last several minutes or more. Cold may relieve the pain. The response to electricity is average or high. If the pulp has been chronically inflamed, a small radiolucent area may show at the apex. The prognosis for conservative treatment is poor.

4. The necrotic pulp may give a history of severe previous pain which stopped suddenly. This may have occurred several years before, in which case the patient does not often remember it. The periodontal membrane may or may not show involvement by tenderness of the tooth, or by the presence of a radiolucent area at the apex. Although generally the crown will show deep caries, abrasion or extensive filling or discoloration, it may appear normal. Thermal and electrical tests are without response, but in making the electrical tests, care must be taken not to touch any metal filling. A pulpless tooth with a metal post may give a response to the electric tester. A tooth with a necrotic pulp requires root-canal treatment or extraction.

It will thus be seen that the dividing line between the pulp that will return to normal and the pulp which becomes totally inflamed or necrotic must be drawn at the stage of pathologic hyperemia, a condition which may be determined clincally with reasonable accuracy. In deciding whether the pulp of a questionable tooth should be treated conservatively by protective measures or more radically by pulp removal or tooth extraction, our chief consideration should be whether the blood vessels are in such a condition that they can regain normal tone and whether infection of the pulp through the dentinal tubules can be prevented. If these questions can, with reasonable certainty, be answered in the affirmative, conservative treatment is indicated.

To protect the dental pulp from the various pathologic conditions just mentioned, we must consider the several ways in which it may be affected: 1. Infection of the pulp through the dentin, the periodontal membrane or the blood stream. 2. Thermal shock. 3. Mechanical trauma. 4. Chemical irritation.

The methods used in protecting the pulp from these sources of irritation have been recognized for some time, but are not always conscientiously practiced. Consequently, we wish to reiterate them and emphasize their importance in partial denture construction.

Bacterial infection causes more pulp

necrosis than any other one factor. The bacterial invasion usually occurs through the dentin as the result of deep seated caries, but the fact that gingival lesions often infect vital pulps through the periodontal lymphatics should not be overlooked. Ann Nichols, of Northwestern University, found micro-organisms in 41 per cent of vital pulps of teeth free from decay but with slight pyorrheal lesions[1]; while Henrici and Hartzell found bacteria present in 42 per cent of vital pulps obtained from teeth "that showed pyorrhea, including even slight degrees of gingivitis."[2]

Consequently, any tooth which presents a gingival infection should be carefully tested and considered before it is made use of in denture construction. The presence of bacteria does not necessarily indicate infection, which is the vascular and cellular response in tissue to the establishment of micro-organisms. Infection via the blood stream sometimes occurs, but it usually becomes established in the pulp because some previous local irritant has lowered the resistance or slowed the circulation through that tissue.

The infection of the pulp through the dentin presents a serious problem. Whenever the carious process has extended deeply into the dentin, we must question the normality of that pulp. We must always be aware of the fact that a vital pulp is not necessarily a normal pulp, for a pulp may be vital and yet be inflamed or degenerating. We feel that all soft carious dentin and any questionable dentin should be removed. We are not in accord with the theory that it is better to leave the last layer of decayed dentin and attempt to sterilize it in some way rather than to remove it and run the risk of exposing the pulp. If the carious process has progressed to such an extent, the pulp is already pathologically altered and probably infected. It would be better policy to remove all the infected dentin, and, if the pulp became exposed in so doing, either to remove the pulp while still vital or to extract the tooth, rather than to leave infected material and so to permit probable pulpal degeneration and necrosis under a filling or crown.

The infection of the dentin and subsequently of the pulp by the saliva in cavity preparation must be given due consideration. Dentin is a vital tissue containing many circulatory channels which normally are protected from the external environment by the enamel. When the enamel is removed in cavity or crown preparation, living tissue is exposed which has less defense against infection and irritation than have most of the other body tissues. No less an authority than Kurt Thoma says[3]:

> The feeling that a tooth which has been cut into by a bur or other instrument represents an open wound must be acquired. A wound in a tooth should have the care and consideration that is given a wound on any other part of the body, perhaps more, because the injured dentinal canals represent a wound-surface more easily infected than a cut in the skin. A tooth does not have the facilities for protection that the soft tissues possess. The cleansing of a wound by hemorrhage from it, and the healing process, which in the soft tissues, includes the formation of a protective crust over the injured surface, are not present in dentin. It is no wonder, therefore, that a pulp becomes infected if a cavity, although properly prepared, is left unprotected for days until a jacket crown is set or an inlay is cemented into place.

The careful operator will see that the dentin is adequately protected from salivary invasion during restoration and that

1. Nichols, Ann C.: J. D. Res., 9:276 (June) 1929.

2. Henrici, A. T., and Hartzell, T. B.: J. D. Res., 1:419, 1919.

3. Thoma, K. H.: J. D. Res., 9:447-486 (Aug.) 1929.

the prepared cavity is sealed between visits. Freshly exposed dentin is ordinarily not exquisitely sensitive. Hypersensitiveness of the dentin often results from the failure to dry the cavity and to see that it is hermetically sealed between sittings. According to Hermann Prinz, the sensitiveness develops as a result of changes in the surface tension of the cytoplasm within the dentinal tubules which are extensions from the odontoblastic layer of the pulp. These surface tension changes result from the absorption of moisture.[4]

The treatment for hypersensitive dentin calls for the employment of sharp-cutting instruments, and drugs which will not shock the pulp to remove the excessive amount of moisture. We prefer to use an essential oil such as eugenol for this purpose. According to G. V. Black, the dentin has a greater affinity for the essential oils than it has for water.[5] Thus, when eugenol is applied to the dentinal surface, the moisture is displaced. It is then volatilized with warm air. It is absolutely necessary to have the exposed dentin thoroughly sealed from the oral fluids if hypersensitiveness due to surface tension changes is to be reduced to a minimum. DeForest Davis, in a paper on pulp conservation read before this section in 1928, recommends sealing the cavity preparations with one of the sedative cements.[6] He believes that such a cement should have both anodyne and antiseptic action.

Many operators sterilize the dentinal surfaces of the cavity or crown preparation with a germicide as a precautionary measure. There are many drugs, such as phenol, in use for this purpose. Other operators contend that results just as satisfactory can be obtained if no drug is applied. It seems to us that this problem needs investigation. If a drug is used, one should be selected which will not discolor the tooth. One should not be used which will shock the pulp owing to its rapid evaporation, as will alcohol. Drugs which might be irritating to the pulp owing to their caustic action should be avoided in deep cavities.

Thermal shock is a common source of pulpal irritation. It may be caused by the generation of heat in cavity preparation or it may result from improper insulation in metallic restorations. Every operator cutting into a tooth which contains a living pulp should keep constantly in mind the fact that heat is being generated which is irritating to the soft tissue within the dentin and the root canal. To avoid an excessive amount of irritation, sharp burs and clean stones must be used, and they must be applied intermittently with sufficient pressure to insure that they are cutting and not burnishing the tooth structure. We feel that it is good technic to lubricate the stones with cocoa butter. This procedure reduces the amount of heat generated and likewise tends to keep the pores of the stones from collecting tooth débris, which would reduce their cutting efficiency. It is preferable to direct a stream of water onto the tooth during the cutting process in crown preparation, especially if the tooth is sensitive. Some clinicians advocate the use of hot water—150 F.—in this procedure rather than the use of water slightly above body temperature. Their contention is that by the time the water has been taken up into the syringe and carried onto the tooth, its temperature has been lowered to a point that approximates that of the body. If the

4. Prinz, Hermann: Diseases of Soft Structures of Teeth and Their Treatment, Philadelphia: Lea and Febiger, 1928, p. 87.

5. Black, G. V.: Operative Dentistry, Ed. 5, Chicago: Medico-Dental Publishing Co., 1922.

6. Davis, O. DeF.: Pulp Conservation in Restorative Dentistry, J.A.D.A., 25:2259-2267 (Dec.) 1928.

water is originally at body temperature, it is much below 98 F. when actually used. Sensitiveness to thermal change following the insertion of a deep seated or extensive metallic filling is a common observation. The usual reaction is a physiologic hyperemia, but if the irritation is long continued, pulp disease will result. It is better, at the time of restoration, to take the steps that are necessary to prevent such future irritation than it is to attempt to relieve the condition after it has developed under the filling. The method employed to obtain this protection is one of insulation. If the cavity is of sufficient depth, a base cement mixed to the proper consistency should be used to protect the dental tubules from thermal change conducted by the metallic filling. If the cavity is shallow, a suitable cavity lining will better serve the purpose. The difficulty here lies in the fact that usually such linings do not insulate sufficiently in the thinness in which they are placed. Many operators relieve the cavity surfaces in their restorations so that the greater bulk of cement necessary for setting them will furnish added protection to the pulp. We see no objection to this procedure provided a sufficient thickness of cement is obtained. Others prepare their cavities and draw the wax patterns without removing all the carious dentin. The carious material is later removed and insulation is furnished by the cement, which will thus occupy the space between the base of the filling and the wall of the cavity.

Heat generated in finishing and polishing may produce a severe pulpitis. Most of the polishing should be done outside the mouth, and that which remains to be done when in place should be executed with utmost care.

If severe sensitiveness develops after the partial denture has been placed, the treatment is to give the tooth rest from further shock. This may be done by having the patient avoid hot or cold foods, drinking hot or cold liquids through a straw; or by constructing a guttapercha cap or crown about the sensitive tooth. After a rest period, usually of a few days, the tooth may be gradually brought into use, but sudden thermal shock should be avoided for some time.

Pulp disease sometimes results from mechanical trauma. The irritation in cavity preparation which results from the use of an untrue stone revolving several thousand times per minute may be sufficient to produce soreness. Indeed, it may result in serious pulpal injury. The influence that the traumatic occlusion, which is caused by setting a so-called "high" crown or filling has on the health of the dental pulp is not always appreciated. The inflammatory changes which are produced in the periodontal membrane because of the sudden extra stress of occlusion may extend into the pulp tissue. It is well to check the occlusion with articulating paper and also to detect any possible movement of the tooth by placing the finger along the buccal or labial surfaces of that and adjacent teeth when the patient bites under pressure. If the bite is not proper, it should be immediately corrected.

The pulp may be excessively traumatized or actually exposed by radical cavity preparation. A discussion of cavity preparation is not relevant to this paper, but we wish to point out that many pulps are needlessly involved by extensive cutting, either for retention or through disregard of dental anatomy. Modern dentistry has given us technic and materials which make extensive preparation for strength and retention obsolete. The best way to protect the dental pulp is to stay as far away from it as possible. No more tooth structure should be removed than

is actually necessary. Modern teaching has also shown us where to place cavity margins in order to secure the minimum of secondary decay. This is an important consideration for the well being of the partial denture as well as for the dental pulp.

It is advisable to do all the cutting that is necessary for cavity preparation in any particular tooth at one sitting. If the preparation is not completed with one visit, the dentin is usually ultrasensitive on subsequent visits, especially if it has not been hermetically sealed. This is, of course, due to pulpal reaction. We believe that continued irritation on succeeding visits is adding insult to injury, and, as such, is exceedingly detrimental to pulpal health.

A pulp may become irritated chemically by improper mixing of the cement used as the base or in the setting of the partial denture. The cement should be mixed slowly and over a large area of the slab so that much of the heat produced by the chemical reaction is absorbed by the slab. All of the liquid should be thoroughly incorporated with the powder so that no free acid remains to irritate the cytoplasm in the dentinal tubules. Where caries has penetrated deeply, it is advisable to place a layer of some such substance as thymolized calcium phosphate mixed to a thick paste with an obtundent such as eugenol over the dentinal surface near the pulp. The cement base is placed over this. Such a layer acts as an antiseptic and an obtundent, protecting the pulp from any chemical irritation which the cement might otherwise produce. Desensitizing pastes which contain arsenic or any other drug that is deleterious to pulp tissue should be avoided. If the dentin is too sensitive to be operated on by ordinary procedures, local anesthesia is usually preferable to the use of desensitizing pastes.

SUMMARY

1. The successful outcome for protective treatment of the dental pulp requires that the pulp be normal or nearly so when treatment is begun.

2. The diagnosis of the condition of the pulp is not always simple. The history of pain, the clinical examination, response to thermal and electrical tests and roentgenographic findings are the chief factors to be considered. No single test, such as the electrical, is sufficient.

3. Normal and physiologically hyperemic pulps are amenable to conservative treatment; whereas, pathologically hyperemic, inflamed and necrotic pulps are not. Degenerating pulps offer a special problem, as yet unsolved, in diagnosis and treatment.

4. The forces destructive to the dental pulps are: infection, thermal shock, mechanical trauma and chemical irritation.

5. Protection against infection via the dentinal tubules requires that all carious dentin be removed, and the exposed surface be sealed from oral fluids. Sterilization of dentin by drug action is superficial and limited.

6. Protection of the pulp from thermal shock requires that operative procedure do not overheat the tooth, and that a nonconductive filling material be placed wherever the cavity approaches the pulp. The patient should abstain from very hot or cold fluids or foods.

7. Protection of the pulp from mechanical trauma may be obtained by correcting an excess of occlusion for any position of the mandible. Likewise, operative procedures should use only moderate force.

8. Protection from chemical irritation may be obtained by using only nonirritating drugs and in reasonable amounts, and by sealing all exposed dentin from the access of oral fluids.

Many of the statements which we have made in this presentation are based purely on clinical observation, although laboratory investigation could be conducted to confirm or reject them. To our knowledge, such studies have not been made. In fact, in covering the dental literature on this subject, one finds little that is new or original. We hesitated to accept the invitation to discuss this subject before this section because we had nothing to offer that has not been told many times before. It would seem, therefore, that progress in this important problem is not active, and that serious research and the compilation of accurate clinical data compiled over a period of years are needed by our profession.

A RÉSUMÉ OF IDEAS ON PORCELAIN JACKET CROWN PREPARATIONS*

By HAROLD W. OPPICE, D.D.S., Chicago, Ill.

DENTAL literature contains many books and articles which describe numerous methods of preparing teeth for the reception of porcelain jacket crowns. A review of the modern literature on this subject reveals only one point of agreement among all these authorities. They all maintain that a porcelain jacket crown strong enough to withstand the attritional stress of mastication can be made for any tooth provided the foundation has been properly prepared. We do find that the authors are unable to come to an agreement in their description of the proper foundation, and in the technical procedures necessary to obtain the finished preparation. In these two important respects, they are greatly at variance. The entire literature is confused.

It is my intent to present a résumé of these writings and to correlate, if possible, the findings of the various authors. These will then be considered in the light of personal experience.

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 10, 1933.

INDICATIONS FOR PORCELAIN JACKET CROWNS

All authorities are agreed that the porcelain jacket crown may be indicated for any tooth in the mouth. A few authors have confined the indications to short statements.

Bastian says:

> The porcelain jacket is indicated in many of those cases where formerly the gold shell crown, the Richmond crown, or the dowel crown was used. It is particularly useful moreover, for teeth with vital pulps, for cases requiring the opening of the bite, for peg laterals and for other restorations where it is impossible to get an ideal esthetic result with inlays, silicate cements, etc.

I maintain that porcelain jacket crowns are indicated on any anterior tooth whose supporting structures are healthy, where an accident, malformation, malalignment, or decay has caused its crown to become unsightly and beyond hope of being restored to normal function and esthetics by a less radical restoration. They are also indicated on bicuspids and molars in the same condition, where esthetics is demanded and the economic condition of the patient will permit.

Only a few writers mention any age limit in these indications, although children frequently present hypoplastic teeth or fractured crowns in which there is no pulp involvement. Are jacket crowns indicated for these cases?

Le Gro says: "These cases are admirably taken care of by the use of shoulderless jacket porcelain crowns." Tylman differs with Le Gro on this point when he writes:

> In removing the enamel subgingivally in young patients we destroy the cuticle attachment thereby producing a trauma to the investing tissues which sometimes is the beginning of the end. For this reason we do not advise the placement of a porcelain jacket crown on patients under 18 or 20 years of age.

Fig. 1.—Ground section showing lack of bell-shaped contour in dentin of crown.

Vehe believes that "indications as to age depend upon the condition of the pulp," and whether or not "pulp protection has been built up by decay." Vehe also mentions the point that children are not sensitive about their appearance as are adults, that their play is conducive to fracture of porcelain restorations and that it therefore would be better to restore these crowns temporarily with some other material.

I am of the opinion that in the teeth of most patients under 18 years of age, pulp protection would not have been built up, and therefore a radical preparation of jacket crown type would not be indicated.

PRELIMINARY STUDY OF THE CASE

There is common agreement that there are two phases of this preliminary study. The first requires a roentgenographic examination of the tooth involved. According to Le Gro, this is done "to determine the size and position of the pulp and also to detect any pathological conditions that might be present." The second phase involves the construction of study models so that all remaining surfaces of the teeth may be preserved. These models are espepecially helpful when several jackets are contemplated to relieve unsightly spacing of the anterior teeth. It is wise to fill these spaces on the plaster model, recarve the teeth and then observe whether the result will be satisfactory.

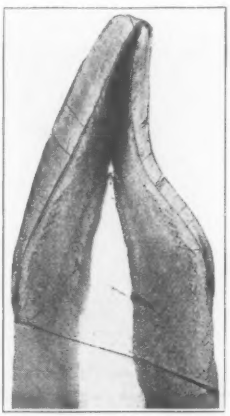

Fig. 2.—Ground section showing lack of bell-shaped contour in dentin of crown.

ANESTHESIA

Many teeth containing vital pulps have been prepared satisfactorily for jacket

restorations with or without the aid of a local anesthetic. There are two points to consider before administering the anesthetic: (1) the comfort of the patient during the operation and (2) the condition of the pulp after the operation. It is paramount that the life of the pulp be preserved. There is no doubt that this can be accomplished with the use of an anesthetic if the operator is extremely careful to prevent overheating. When the operator is doubtful as to his ability to prepare the tooth without injuring the pulp, he should omit the anesthetic and provide for the patient's comfort in some other way. The hot water method of obtunding the pain is recommended by many.

Fig. 3.—Ground section showing lack of bell-shaped contour in dentin of crown.

Fig. 4.—Ground section showing lack of bell-shaped contour in dentin of crown.

TYPES OF PREPARATIONS

If we again consult the authorities on types of preparations, we find that they are particularly confusing, and that there is a great deal of difficulty in determining just what the essayist means to convey to the reader. Before attempting to organize this material into a definite classification, it is well that we understand the requirements of a proper foundation for the porcelain jacket crown.

The superstructure, since it is to be of porcelain, will be friable. There will be an increase in resistance to fracture as the thickness is increased. In all cases, we are limited as to thickness outwardly by the appearance and the demands of occlusion. For teeth containing vital pulps, we are limited as to thickness inwardly by the necessity of preserving the pulp.

Will the amount of tooth structure removed from the crown, without jeopardizing the pulp, permit a thickness of porcelain strong enough to withstand the stresses of mastication? The answer given by all authorities is "yes," but is often followed by one or more "ifs." It is these "ifs" qualifying the answer "yes" and rarely explained clearly that are so confusing to the average dentist.

On the one hand, there are those who say that it is always necessary to make a "shoulder preparation" so that the porcelain is equal to that of average enamel in thickness. On the other hand, there are those who maintain that it is not always possible to make a "shoulder preparation" without endangering the pulp of the tooth. This group advocates a "shoulderless type" for those teeth which are not fully developed and, as Bastian says, "for peg laterals, small upper lateral incisors, lower incisors and also for posterior teeth

where it is almost impossible to cut shoulders correctly." Le Gro, who is given credit for first suggesting this type of crown, says:

> The shoulderless type of porcelain jacket should have a decidedly important place in our armamentarium. Aside from its adaptation to certain types of dental anatomy, it is most decidedly indicated for teeth of children under sixteen years of age.

Tylman writes:

> In every instance, our preference is for the shoulder type except where the tooth is abnormal in form. . . . In those where the access is so difficult that a good shoulder preparation is next to impossible, a shoulderless type is indicated.

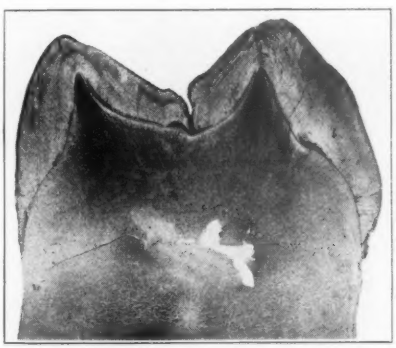

Fig. 5.—Ground section showing lack of bell-shaped contour in dentin of crown.

In direct opposition to these statements we find Avery writing this about shoulderless jackets:

> We condemn this method strongly. We do not believe the edges sufficiently strong. It gives a false gingival contour and is careless technic. It has a feather edge, and is weak. . . . I believe that there was never a tooth in an adult mouth, either peg lateral or lower incisor, in which a small but definite shoulder could not be prepared and a butt-joint obtained, which would make possible a perfectly finished jacket that would not irritate the gingivae nor endanger the pulp.

Experience has taught me the weakness of a feather edge of porcelain and the fact that a small shoulder can be definitely made on any tooth without injury to the pulp. A study was made of ground sections to determine whether any bulge or bell-shaped contour could be found in the dentin of the crown. After an examination of hundreds of these sections, it can be said that the bell shape of the crowns of our teeth is found only in the enamel and never in the dentin. There is no constriction in the dentin at the junction of the crown and the root. (Figs. 1-5.)

I shall proceed on the logical basis that a shoulder is essential to a good jacket preparation. There are three points in controversy regarding the "shoulder" type: (1) removal or nonremoval of all enamel in the gingival area; (2) the angle of the shoulder, and (3) the position of the shoulder in relation to the gingival crevice.

Removal or Nonremoval of All Enamel in the Gingival Area.—This is a moot point about which much has been written. H. Spaulding Both, in describing his method of preparing a vital tooth for a jacket crown, says:

> The next step is to remove *all* the enamel from the tooth. This is essential as will be seen later. . . . If all the enamel has been removed from the tooth—and I cannot stress this point too strongly—the cutting of the shoulder in the softer dentin becomes a very simple matter.

We now find Vehe writing "that the removal of all enamel is out of the question without irreparable injury to the gingival tissues until later in life." Argue advises the same procedure by saying: "Fundamentally, the enamel below the gingival should not be disturbed in any case of a young patient, for the reason that the permanency of any operation depends only on how the health of this gingival soft tissue is maintained." The two latter statements are more in keeping with recent findings of the dental histologists than is that of Both's. The histolo-

gists tell us that the gingival tissues are usually attached to enamel in the gingival area until the patient has reached middle age and that it is important not to injure this attachment when preparing teeth for jacket crowns.

It is logical, therefore, to classify the two types of teeth containing vital pulps for jacket preparations: (1) those teeth in which the gingival tissues are attached to enamel as well as cementum, and (2) those teeth in which the gingival tissues

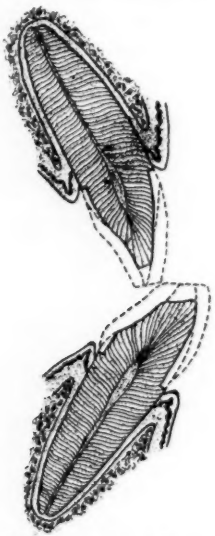

Fig. 6.—Ideal upper and lower porcelain jacket crown preparations where gingival tissues are attached to enamel as well as cementum.

are attached only to cementum. It will be noted that in the first classification, a shoulder could be made without the removal of any dentin whatever. This is a decided advantage, since it is in this group that we find the teeth of our younger patients in which the pulp recession is negligible. It will be noted further that the second classification requires the removal of some dentin in order to secure the shoulder. This can be done without pulp injury, since these teeth are found in the mouths of older patients, in whom pulp recession is greater.

Angle of the Shoulder.—So much at variance are the opinions on this point that conflicting and confusing statements predominate. Slocum speaks of "beveling the shoulder inward and downward with the correct file." Both says: "The

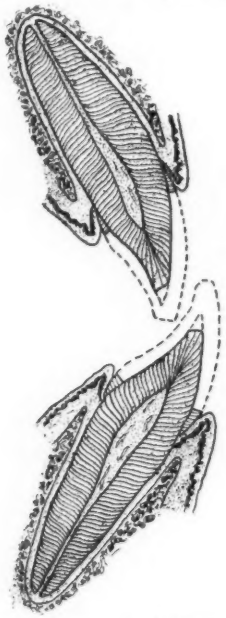

Fig. 7.—Ideal upper and lower porcelain jacket crown preparations where gingival tissues are attached to cementum only.

shoulder is trimmed with a narrow chisel or with files of convenient size, so that the floor is perfectly smooth and at a sharp right angle to the conical stump now remaining and flaring slightly outward toward the periphery." Argue holds that:

The standardized form consists of a shoul-

der cut at right angles to the axial surfaces. Where the axial surface meets the gingival surfaces of the shoulder, there should be a definite acute angle to give resistance and anchorage to the porcelain. If the patient is at an age at which the enamel is left, a slight bevel should be given to these rods.

Vehe writes:

The beveling of a shoulder margin might be questioned. An attenuated, acute-angled margin on either the porcelain or the enamel would easily be liable to fracture, and to most safely protect both of these margins it seems logical that right angle margins would give the greatest possible protection to both structures.

Bastian is of the opinion that "this shoulder is made at right angles to the long axis of the tooth." Le Gro indicates, by word and picture, that there are three different types of shoulder angles permissible: "the ideal, the square and the beveled." It can easily be assumed from this that the "ideal type" should be made if possible. The "square type" is the next choice. The "bevel type" will do if either of the others is too difficult. Felcher gives us another view of this problem when he writes:

There are some who believe that beveled shoulders give greater advantages than flat shoulders. . . . The cutting of a V shoulder was recently suggested. . . . We observe many cases where the shoulder preparations are not ideal, yet these cases carry successful restorations.

I am of the opinion that the simplest way of determining the angle of the shoulder to prevent fracture of the crown is the following: The resistance to fracture or dislodgment is best obtained from surfaces which are at right angles to the applied force. The normal surfaces of the dentin of any tooth are either parallel with, or at right angles to, the attritional forces. Those surfaces which are at right angles to the attritional forces must offer a resistance that will prevent the fracture or dislodgment of the artificial crown. Therefore, the shoulder of jacket crown preparations together with the incisal or occlusal surfaces should be in planes which are at right angles to the forces of

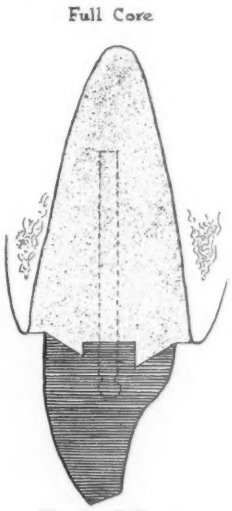

Fig. 8.—Full core.

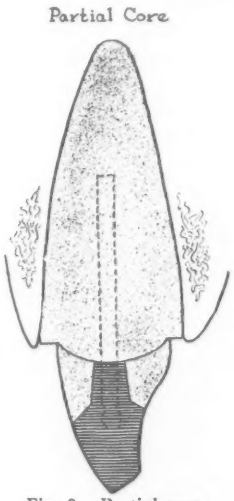

Fig. 9.—Partial core.

mastication. As a final conclusion, we hold that since the axial surfaces of the dentinal portion of the preparation are parallel to the forces exerted during mastication, the shoulder should be at right angles to the axial surfaces.

The following quotations from McBean supports this reasoning:

> In preparation for a porcelain jacket crown, the occlusal and incisal surfaces should be reduced to a uniform thickness of not to exceed 1.5 mm.; the natural markings of these surfaces of the tooth being maintained and thereby a seat produced for the porcelain at right angles to the line of force applied in the act of mastication. A thin veneer of porcelain supported at right angles to the line of force applied, has greater strength than a bulk of porcelain unsupported.

Position of the Shoulder in Relation to the Gingival Crevice.—Two entirely different opinions are found in the literature on this point. Adolph Schneider writes:

> By carrying our shoulders as near as possible to the gum and tooth attachment, and giving our gingival porcelain the correct contour, we free the gum from irritation and protect our cement margin from disintegration, for the free gum margin will hug the tooth so tight that nothing can get in to disturb it.

In direct contradiction to this statement, we find Thompson writing:

> The recommendation that the shoulder should be carried as far under the tissues as possible, or to the attachment, I believe to be wrong, because when we take our impression we must force our band above the margin of the shoulder to secure an accurate impression of it, and if the shoulder is at the attachment, injury to the peridental membrane would result.

Argue also disagrees with Schneider when he maintains:

> We should take care in operating . . . not to carry the shoulder of the preparation any further than just well under the free edge of the gingivae. Make this a rule, and when the normal recession takes place and the joint becomes unsightly reoperate . . . if the operation is carefully followed out, little if any abnormal recession will take place.

A few writers advocate the use of guttapercha to depress the gingival tissues in order that the shoulder may be cut closer to the tissue attachment. In referring to a guttapercha cap, Sykes says, "On the second appointment, this is removed. One then has a full view of the field of operation and can form a clear, well defined shoulder, without injury to the gingival tissues." Megaw also recommends this practice when he says:

> Now pack the gum and dismiss the patient for twenty-four hours. Temporary stopping or guttapercha may be molded over the tooth, passed well between and under the bulge of the adjacent teeth, applying pressure that blanches the gum around the tooth.

It is my firm belief that any attempt to depress normal gingival tissue is unnecessary. Furthermore, this practice defeats the purpose of its use by irritating the gingival tissues to the point of enlarging the gingival crevice.

McBean, in one short sentence, suggests what I believe to be the correct procedure: "When the tissues are all in normal relation, the shoulder should be prepared just beneath the free margin of the gum, and not at the cemento-enamel junction."

To this point, I have attempted to prove that there should be but two different types of jacket preparations for teeth containing vital pulps, and that the angle of the shoulder should be the same for both. Our classification would not be complete if we did not mention the jacket preparation for pulpless teeth. The finished preparation for these teeth is the same as that for teeth containing vital pulps, although the technical procedures involved are different. Precious metal cores are used to replace that portion of the dentin of the crown which has been destroyed. For convenience of description, this preparation is divided by most authorities into two types, the full

metal core and the partial metal core.

The discussion now has evolved the following classification of the types of preparations:

1. Teeth containing vital pulps: (*a*) with the gingival tissues attached to the enamel as well as the cementum (Fig. 6); and (*b*) with the gingival tissues attached to the cementum only (Fig. 7).

2. Pulpless teeth: (*a*) requiring a full core (Fig. 8); and (*b*) requiring a partial core (Fig. 9).

TECHNIC OF PREPARATION

A mental picture of the finished foundation obtained by proper classification is of great assistance in carrying out the technical procedures of preparation. To review all the different methods of technical procedure would be of little value. The result obtained is the important point, the method of securing it, whether it be yours or mine, making little difference. Therefore, only the methods which have proved satisfactory in my hands will be set down here.

TEETH CONTAINING VITAL PULPS

I. *The Removal of the Enamel from the Visible Crown.*—(*a*) From the incisal edge or occlusal surface remove an amount equal to the normal thickness of enamel (from 1 to 1.5 mm.) with a "heatless" stone.

(*b*) On the proximal surfaces, remove an amount equal to the thickness of normal enamel with a "Jo Dandy" safe-side disk.

(*c*) On the labial or buccal surfaces: (1) cut a groove at the base of the visible crown, the depth of the enamel, with a small knife-edge stone. This groove should follow the festoon of the soft tissues; (2) cut a similar groove from the one just made to the incisal edge and keep it close to one of the proximal surfaces; (3) insert a small chisel in the last groove and chip away the enamel. A continuation of this process will remove the enamel from the remaining portion of these surfaces.

(*d*) On the lingual surface: (1) cut a groove at the base of the visible crown similar to the one made on the labial; (2) grind away the enamel with an inverted cone shaped stone, using a mild pull motion, starting in the groove at the base and finishing at the incisal edge. The repetition of this process will remove the enamel on this surface.

(*e*) On the proximolabial and the proximolingual angles, plane with a No. 56 fissure bur until all enamel is removed.

Regardless of the methods employed, it is most important not to proceed beyond this point in the preparation until all enamel is removed from the visible crown. It is also important to remember that the removal of more than the thickness of ordinary enamel from this area is unnecessary for the strength of the completed crown and would endanger the life of the pulp.

II. *Removal of Remaining Enamel on the Anatomic Crown.*—When this enamel is to be removed (indicated or contraindicated from our stated classification) it is done with small enamel cleavers, such as Johnson's No. 1 and No. 2. This procedure is followed by the use of small files to render the dentin smooth.

III. *Preparation of the Shoulder.*—In tooth type I-A, in which the gingival tissues are attached to enamel:

(*a*) A definite width and angle is given to the shoulder by planing with a fissure bur No. 56.

(*b*) The shoulder is carried into the area of the gingival crevice with an end cutting bur No. 900S.

(*c*) Shoulder files or small enamel chisels are used to assist in smoothing the shoulder.

In tooth type I-B, in which the gingi-

val tissues are attached to cementum only:

Since no shoulder is outlined by the removal of all the enamel on the anatomic crown, one must be made in the dentin. This is done by making a small depression completely encircling the tooth at the base of the visible crown. Evan's gingival trimmers or plain fissure burs are used for this purpose. The shoulder is then properly angled and carried into the area of the gingival crevice as explained above.

IV. *Toilet of the Preparation.*—The preparation is completed by making the surfaces thoroughly smooth and by beveling the incisal surface or the cusps of the occlusal surface so that it or they will be at right angles to the forces exerted during mastication.

PULPLESS TEETH

I. *The Full Core.*—The surface of the root is ground with a stone so as to be on a level with the soft tissues surrounding it. By means of the casting process, a core of precious metal is constructed to resemble the dentinal portion of the original crown, except at the gingival aspect, where a definite shoulder of tooth structure is left protruding beyond the core. After this metal core has been cemented to place, the shoulder is carried into the area of the gingival crevice with an end cutting bur.

II. *The Partial Core.*—Many pulpless teeth have enough coronal dentin remaining on which to build a partial core by the casting process.

Full and partial cores are often made too short at the incisal or occlusal aspect, the fracture of the cemented crown resulting when stress is applied. This is due to the increase in the length of the power arm as represented by the added amount of porcelain at the incisal or occlusal.

CONCLUSIONS

1. The ideal preparation for a porcelain jacket crown would be a reproduction of the clinical crown minus the enamel and plus a shoulder.

2. The tooth to be restored must be placed in its proper classification. A mental picture of the ideal foundation must be obtained and the proper skill necessary for the technical procedures must be shown. Then, and then only, will the result be a finished, satisfactory and competent preparation for the porcelain jacket crown.

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THE IMPORTANCE OF FOCAL INFECTION IN GENERAL HEALTH OR THE RELATIONSHIP OF THE TEETH TO HEALTH*

By CHARLES A. ELLIOTT, M.D., Chicago, Ill.

THE subject of the relationship of the teeth to general health continues to hold the attention of both the dental and the medical profession. To have the opportunity of discussing it before a representative group of oral surgeons from the point of view of the physician is a privilege.

The medical profession views with great interest the progress that has been made by your profession in the mechanics of dentistry, the preservation, repair and replacement of teeth. We marvel at your ability to preserve devitalized teeth as useful instruments in the process of mastication. With time and the accumulation of clinical experience, we realize that you now possess a keen realization of the dangers, in terms of pathogenesis of disease, inherent in the procedure of ruthlessly devitalizing teeth, and entertain grave doubts as to the wisdom of such practice. We observe with even greater interest and approbation the development within your ranks of an appreciation of what can be, and, to a considerable extent, already has been, accomplished in the prevention of dental disease through a conscious effort on your part to educate the people in matters of dental hygiene. Finally, with the development within your profession of sound tenets comparable to the best surgical practice in other fields as to the measures to be adopted in the diagnosis and management of den-

*Read at the fifteenth annual meeting of the American Society of Oral Surgeons and Exodontists, Chicago, Ill., Aug. 5, 1933.

tal disease, if and when found, physicians now experience a sense of trust and dependence on your judgment such as has not existed in the past.

Statements such as these are not mere platitudes. They apply, however, only to the best dental practices by thoughtful men within your profession. Unfortunately, individuals are to be found within both professions who, through ignorance or neglect, continue to subject their patients to avoidable dangers. We all should be intolerant of such men and such practices. Fortunately, there is available an ever-increasing group of excellently trained oral surgeons and dentists who appreciate the relationship of teeth to general health, and on whom the medical profession may now rely with confidence, when the general health of the patient is at stake.

The dependence of the nutritional state of the body on the teeth as a masticating mechanism is obvious and requires no discussion at this time other than the statement that general practitioners of medicine are apt to underestimate the importance of an adequate masticating surface as a prerequisite of good health. Conversely, the conception that the structure and preservation of the teeth are dependent on the nutritional state of the body, implying an adequate and complete diet containing all necessary foodstuffs, including minerals and vitamins, and presupposing a normally functioning calcium mechanism, is sufficiently demonstrated and may be accepted as correct in principle and practice. There exists, therefore, a reversible relationship between the teeth on one hand and the state of nutrition of the body on the other, which may determine the anatomic and physiologic integrity of both.

Needless to say, many problems within this field await solution. However, a sufficient backlog of facts has accumulated, largely as a result of experiments on the nutrition of animals at the hands of animal husbandrymen and physiologists, to permit the therapeutic manipulation of such factors in the practical management of patients with a fair degree of certainty of beneficial results.

The problem of oral infection in relationship to general health is somewhat different. In common with many other clinical problems, the effect of oral infection on the human economy must be judged largely on the basis of the accumulation of clinical experience rather than by setting up a crucial scientific experiment with adequate controls. Animal experimentation within this field does not completely answer the problem, and clinical experience, save in the presence of a great mass of carefully recorded observations, dispassionately evaluated, may be incomplete and fallacious.

A thorough appreciation of the scope of the problem of oral infection and a realization of the difficulties encountered in a true evaluation of the effects of oral infection on general health in terms of scientific accuracy is appreciated by some, but not by all within both professions. Although much has been accomplished in recent years in the study of oral infection in its relationship to general health, the problem as a whole remains far from solved. The exact demonstration of the effects of oral infection on the general health in terms that satisfy scientific criteria has not been accomplished save in most general terms, and a true clinical appraisal of the results of the eradication of oral infection in terms of relief of human disability remains an incomplete clinical problem even at the present time.

Infections are believed to be responsible for the majority of illnesses with which the internist is concerned. Roughly, 75 per cent of all internal medical diseases are believed directly or indirectly to be

due to infection. In general infections such as typhoid or syphilis, the direct relationship of the invading organism to the disease is obvious and easily demonstrable. In the acute exanthematous diseases such as scarlet fever and measles, and in acute rheumatic fever and chorea, the direct relationship of a specific organism to the disease may not have been demonstrated but may be accepted as a reasonable hypothesis. This is not the case with many chronic diseases believed to be indirectly or remotely caused by infections. Chronic valvular heart disease, chronic nephritis and chronic pancreatitis may be mentioned as examples of this group in which an etiologic relationship to infection is assumed with logic but may not be demonstrated. In diseases of the endocrine glands such as exophthalmic goiter, diabetes and hyperparathyroidism, the relationship of the disease to an infective agent is less obvious, and the clinician at the time the patient seeks medical advice is rightfully concerned with the resulting disturbance of metabolism and its management, but gives scant thought to the infection which may and probably often does originate such a process.

The history of such patients is of first importance in incriminating an infection as the primary etiologic factor concerned. From the history, it may be determined that an acute general infection or an acute or chronic local suppurative process about, let us say, a tooth, or possibly the extraction of an infected tooth immediately preceded the onset of symptoms for which the patient seeks relief. At the time the patient seeks medical advice, it may be difficult, if not impossible, to demonstrate the etiologic relationship of infection to such processes. The infection proper may have entirely burned itself out although the anatomic and consequent physiologic disturbances remain and may even progress. The frequency with which such a sequence is encountered in medical practice is so great that the assumption that an etiologic relationship between a general or a local infection and subsequent constitutional disease frequently exists cannot be lightly brushed aside.

The conception of the behavior of bacteria and the mechanism by which they produce disease within the body has undergone remarkable changes in the past few years. The days of the descriptive bacteriologist, interested in the morphology and cultural characteristics of bacteria, are gone forever. New concepts concerning the changing morphology, reactivity and filterability of organisms and the mechanism by which tissues may harbor or react to infection are gradually evolving. The conception that bacteria may cause disease by direct invasion needs no defense at this time. The conception that the defense mechanism of the body is of equal importance in determining invasion of the body tissues, while well known, is apt to be overlooked.

The mere demonstration of the presence of bacteria, let us say about a tooth, is no criterion upon which to assume that they may be causing disease. It is now well known that apparently normal tissues commonly harbor bacteria. Years ago, Adami called the attention of the medical world to the fact that bacteria could be cultured from the normal liver, and recently Edmund Andrews has demonstrated that both the liver and skeletal muscles may normally harbor bacteria. Such observations have recived but scant consideration at the hands of members of our professions.

Much has been said about the selective localization of bacteria, as though this were an inherent quality of the organism. It seems more probable that when bacteria enter the blood stream, they are

distributed to all the tissues of the body. Their survival, growth and pathogenic possibilities within a tissue depend on the presence or absence of the living conditions which they require. This is well illustrated in the case of *Streptococcus viridans,* which is so frequently found in foci about the teeth. It is, in fact, so frequently found in these locations that it may almost be considered a saprophyte. It grows under conditions of low oxygen pressure and, therefore, frequently produces lesions within the heart valves and in tendon sheaths and synovial membranes about joints—tissues which receive a limited blood supply and presumably but little oxygen.

Bacteria may cause disease in other ways than by direct infection. This may occur in asthma, iritis, tuberculosis and rheumatism. Sensitization of a tissue to the products of infection often located at a distance from the lesion is now recognized as playing a considerable rôle in the production of local lesions. Such allergic phenomena are not uncommon. Vaughan, many years ago, demonstrated the facility with which the conjunctival sac of a rabbit may be made sensitive to a specific organism and later respond by an acute inflammation not directly due to bacterial invasion whenever the animal as a whole or the opposite conjunctival sac may be inoculated with the living or dead specific organism to which it is sensitized.

The remarkable advance in our understanding of tuberculosis in the past decade is largely dependent on a better appreciation of the significance of allergic phenomena. A true explanation of the von Pirquet reaction, and a better understanding of the reaction of tissues sensitized to the tubercle bacillus, but not necessarily infected by it at the time, has resulted in the adoption of effective means in combating tuberculosis and accounts to a large extent for the material reduction in the mortality rate of this disease in recent years. Somewhat similar comments may be made concerning rheumatism. It is now generally believed that some of the arthritic phenomena observed about joints in both acute and chronic rheumatism may be explained as allergic reactions.

An examination of an adult who seeks medical advice on account of particular complaints is never complete without a careful search for focal infections. This should not imply that such foci may be considered in relationship to his present illness, although this may finally be considered to be the case, but it does mean that all existent foci should be detected if possible, and taken into consideration in the evaluation of the patient's health status.

It is characteristic of focal infections that they are for the most part nonsymptomatic regardless of what rôle they may play in the disease process. As far as the patient himself is concerned, they are nonexistent or considered of trivial significance. The ingenuity of the physician may, therefore, be taxed to the limit, not only in demonstrating that such foci exist but also in evaluating their importance when discovered in relation to the patient's chief complaint.

All credit is due Frank Billings for having emphasized the importance of focal infection. Following his dynamic lead, the American medical profession at least seemed to have lost all sense of proportion in their zeal to eradicate focal infection. In a recent conversation, one of the men who assisted Dr. Billings in the work on focal infections at the Presbyterian Hospital remarked that, on looking back over that experience, he now realized that Dr. Billings' dynamic personality was a large factor in obtaining the beneficial results which patients

claimed to have received after the elimination of demonstrated local infections.

While there can be no question that foci of infection may cause disease in general, the relationship of demonstrated focal infection to the disease of any individual case remains, and I believe always must remain, a question which can rarely be decided with certainty. Furthermore, the frequency with which focal infection may cause disease is still an unknown quantity. There can be no question that chronic tonsillitis, chronic oral infection, chronic sinusitis and chronic prostatitis—probably in the order named—and also chroic infection of the gallbladder, appendix and rectum, as well as of other regions, may on occasion originate or precipitate disease in distant organs, and may not infrequently be an important contributing factor in anemic states and general debility. I believe the medical profession is tending toward a more conservative point of view, somewhat as just stated, in its attitude toward focal infection. The mere demonstration of the presence of foci does not necessarily presuppose that under all circumstances they should be eradicated. In the last analysis, it becomes a matter of exercising good judgment in the individual case.

The case of oral infections, save in a few details dependent on the nature of teeth, is no different from that of focal infection in general. Caries, apical infection, the presence of devitalized or impacted teeth and pyorrhea, probably in the order named, are not infrequently thought to be responsible for focal infection and the instigators of general disease. The physician must know his patient and evaluate, if possible, the relationship that focal infection may have to his illness. In his relationship with the oral surgeon, it is duty of the physician, as I see it, to inform the oral surgeon as to the relationship that focal infection in general and oral infection in particular may have to the illness of which the patient complains. Under all circumstances, the patient and the physician, as his advisor, are entitled to an exact statement of opinion by the oral surgeon as to the presence and extent of oral infection. Occasions will arise when it seems the part of wisdom that oral infection be radically eliminated; whereas, under other circumstances, such radical treatment may not seem warranted.

Physicians who have given the subject serious thought are interested in the proposition that strengthening the resistance of the body to infection by adequate diet, the administration of cod-liver oil or viosterol, sun baths, quartz-light treatment, iron therapy or, on occasion, sending the patient to another climate may lessen the threat of a focal infection, and, under the circumstances, be more appropriate treatment for an individual patient than the more radical surgical removal of teeth. In debilitated, anemic or senile patients, such conservative management may not infrequently seem best.

CONCLUSIONS

The present-day conception of the relationship between oral infection and general health is based on incomplete clinical evidence. Crucial experimentation and adequate controls are lacking. Final statements must, therefore, be deferred. Clinical experience seems to warrant the following statements:

1. Oral infection is a potent factor in the production and continuance of ill health and should always receive serious attention.

2. Other conditions being equal, manifest oral infection should be eradicated when possible in principle, as a matter of health insurance and, in addition, with the hope, but not the assurance, that it

may modify or control the disease from which a patient seeks relief.

3. Presumptive but not demonstrated oral infection should receive conservative consideration. Many factors have to be taken into consideration: the general condition of the patient, the seriousness of his complaint, the probability or improbability that his illness is due to or influenced by oral infection, and, finally, the possibility of other etiologic factors than oral infection being present. Certainly the wholesale extraction of devitalized but not manifestly infected teeth is to be condemned.

4. No medical examination is to be considered complete without an appraisal of the state of health of the teeth. Save where teeth are obviously immune to caries, the diagnosis of oral infection should rest with the oral surgeon trained in his special field. Conversely, judgment as to the relationship that oral infection may have to the general health of individual patients should rest with the physician. Fortunately for the patient, much more exact knowledge within these two fields is available today than ever before. The interests of the patients are best served when the two professions render their services conjointly.

DISCUSSION

Boyd S. Gardner, Rochester, Minn.: Dr. Elliott's paper stresses the need of greater cooperation between physicians and dentists. I do not like to hear just the term focal infection, in referring to cooperation between the two professions. Many physicians believe that we as dentists are interested in dental infection from the focal standpoint only. We should broaden out and think of dental infection as a physical load or drag, in addition to its being a direct cause of disease elsewhere in the body, and there should be a better understanding as to what is really meant by dental infection. Some dentists believe that a pulpless tooth that is roentgen-ray negative cannot be a source of infection, while others take the opposite view. As dentists, we have extracted infected teeth and have been discouraged in the result, but now, as more interest is being shown in the repair of bone after extraction, we think that we can account for some of these discouragements. In other words, we should see that our patients receive a correct diet or diet reenforcement that will lay down new bone in the sockets where teeth have been extracted, in the minimum of time. We should become better dental diagnosticians, and study the difference between the maxilla and the mandible. As MacMillan, of Cincinnati, pointed out to us many years ago, the location of the apex of a tooth has a marked bearing on the interpretation of roentgen-ray evidence. More and more, we are seeing in our clinic that our work compares favorably with that of the orthopedic section, as we are both interested in the management of bone infection and are learning more as to why bone is not regenerated so quickly in one patient as in another. For this reason, we can account for the residual areas that we find. I do not wish to belittle the necessity of curettement following extraction of teeth, but I believe there would be fewer residual areas left, and less starved looking bone, if we become more interested in the intake of calcium and phosphorus, with vitamin D. The public is going to expect more from the dentist in the future than it has in the past, and more attention will be paid to the prevention of dental disease. The public is going to make certain demands that will force the dentist to pay more attention to the diet of his patient whether he is interested in the filling or restoration of teeth, treatment of pyorrhea or surgery.

Earle H. Thomas, Chicago, Ill.: We realize that medicine is not an exact science and that all we know about focal infection is not exactly scientific. All we have to depend on in these cases is our clinical experience. We talk about possible and probable infection around the mouth; we talk about infection that is potential, and we talk about infection that is, we think, definitely connected with the general condition

of the patient. There is no one who knows in advance the comparative virulence or the comparative detrimental possibilities of any type of infection around the mouth. If, in one place in a mouth, there is a roentgenographically negative pulpless tooth and at another place a chronically abscessed tooth with a large area of bone destruction around it, a large granuloma, there is at present no way of determining which one is the more detrimental. The pulpless tooth, roentgenographically negative, may be by far the more serious and the more probable cause of the systemic trouble, if it is due to focal infection. This is demonstrated clinically almost daily in every extensive oral surgery practice.

Harry M. McFarland, Kansas City, Mo.: Focal infection does not always cause symptoms which may be recognized. One may carry a considerable amount of infection over a long period of time, apparently without any discomfort. We do not always know when we are in normal health. Patients delay having corrections made, thinking that they are getting along all right, when as a matter of fact, they carry infection over a period of years which may bring about a permanent systemic disturbance; and the removal of the source of infection will not correct the condition after the damage has been done. We have compared the infection from the apices of devitalized teeth with that secured from a pyorrheic area in the same mouth. We have had an opportunity to do this work in the hospitals under the most favorable conditions. By removing the apices of devitalized teeth and making the cultures in the clinical laboratory, we found the presence of *Streptococcus viridans,* and we also found the same type of infection in a case of pyorrhea. There was a much more profuse growth from the pyorrheic granulomas than from the apices of the devitalized teeth. With this in mind, I am emphasizing the importance of the eradication of all types of infection. Those of us who are specializing in oral surgery should recognize our responsibility to health welfare and give the medical profession the cooperation which they so justly deserve.

Dr. Elliott: Apparently, bacteria tend to localize in certain structures, this depending on characteristics inherent in both the particular bacterium and the particular tissue concerned. For instance, *Streptococcus viridans* tends to localize *about* devitalized teeth, *around* joints and *within* heart valves. The pneumococcus, on the other hand, tends to localize *on* the surface of heart valves and *within* joint cavities. These differences are probably due to the fact that conditions suitable for the growth of these organisms are to be found in these particular locations. Bacteria when they gain entrance to the blood stream are most probably carried to all parts of the body. They are probably carried wherever the blood goes, but persist and become capable of producing disease only in areas suitable for their preservation and growth. The frequency with which tissues harbor infection varies greatly. Clinical experience indicates that the tonsils, the nasal sinuses, the teeth and the prostate, more frequently than most other structures, harbor bacteria in the sense of serving as foci of infection. We must not forget that normal structures, such as the liver, as demonstrated by Adami years ago, and the skeletal muscles, as pointed out by Edmund Andrews, may also harbor viable bacteria. This phenomenon is not to be considered as identical with the conception of foci of infection. Apparently the structures about a devitalized tooth are especially prone to attract and, on occasion, to harbor bacteria, especially *Streptococcus viridans.* We do not know, or indeed believe, that all devitalized teeth are of necessity foci of infection, but certainly such a possibility should come under critical consideration by both the clinician and the oral surgeon. I believe that our attitude toward devitalized teeth without demonstrable infection should be a conservative one; whereas, demonstrable infection about such a tooth probably should be eradicated as a matter of insurance against future disease, if for no other reason, but also with the hope that it will affect the condition for which the patient seeks relief.

Dr. Gardner: I would like to have you

differentiate between liver and muscle tissue and a chronic focus at the root end of a tooth. You say they are the same.

Dr. Elliott: I mean that although bacteria have been demonstrated to exist in apparently normal structures such as the liver and skeletal muscles, we are not prepared to consider these in the same light as we do demonstrable localized lesions due to infection such as chronic oral or tonsillar infection. Just what the rôle of any bacteria found in normal tissues may be in the production of disease in general is unknown.

Dr. Gardner: My question concerned the possibility of an infected tooth's ability to return to normal as compared with that of muscle tissue. I might have an abscess in a muscle and it would finally heal and, as you say, a physician could not determine that I had had one; but that is not the case when we have as a chronic focus in bone.

Dr. Elliott: You are, I think, right in this conception.

DENTISTRY AND PHARMACY IN THERAPEUTIC PROGRESS*

By HAROLD S. SMITH, D.D.S., and SAMUEL M. GORDON, Ph.D.,† Chicago, Ill.

COOPERATION between members of the professions engaged in the healing arts is necessary in developing a proper sense of proportion. The artificial lines that separate dentistry, pharmacy and medicine developed through the growth of specialization, which has been so widespread in certain fields that specialists have been unaware of what co-workers in neighboring fields were doing. Dentistry, pharmacy and medicine, having a common historical origin, find it desirable to meet for a consideration of common problems. The American Association for the Advancement of Science provides such a medium.

The U. S. Pharmacopeia, the guide to rational prescribing, and the joint work of physician and pharmacist, is of interest to a wider scientific circle, and, in the last analysis, to the public. Its scientific character bespeaks the devotion to scientific and rational drug therapy of two great professions. Dentistry, although it has been a healing art from earliest time, having gone through the same evolution as medicine and pharmacy—through the priest, dealer in witch-craft, itinerant dentist, guild, college, etc., has been mistakenly considered as having only a passing interest in pharmacy and the pharmacopeia. On the contrary, dentistry has a real interest in pharmacy, as will be pointed out.

Dentistry and pharmacy have much in common, even as medicine and pharmacy. This at times may have been overlooked, probably because of the emphasis that has been given to the restorative aspects of dentistry. The present trend in dentistry is toward prevention, although, to be sure, the operative and prosthetic

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aspects of dentistry will continue to occupy a large part of dental practice, just as orthopedic surgery, for example, has not been entirely displaced by the newer knowledge of nutrition. The dental curriculum of today emphasizes the relationship of physiology, bacteriology, pathology, biochemistry and other basic sciences to the treatment of dental disease. The study of the action and uses of drugs occupies a fair proportion of the dental curriculum.

Drugs have been used for correcting and alleviating dental disorders since earliest times. Reference to the use of drugs for the relief of toothache is found in the earliest manuscripts. Drugs were used in an attempt to control dental caries in the earliest practice of dentistry. Large amounts of astringents and disinfectants were used in treatment of disease of the gums. The dental profession is associated with the discovery of the anesthetic properties of ether and nitrous oxide, through the work of Morton and Wells. Dentists were instrumental in large part in determining clinically the local anesthetic properties of cocaine and the numerous synthetics related to it, which finally culminated in the discovery of procaine. It is estimated that the greater part of all the procaine manufactured, and a large amount of the epinephrine, is now used in dental procedures.

Dental surgeons treat pathologic conditions of the soft and hard tissues of the oral cavity and adjacent areas. In the practice of oral surgery and in the every day practice of dentistry, large amounts of anesthetics, germicides, analgesics and hypnotics, hemostatics and other drugs are used.

With the appreciation that dental caries is related in some way to the problem of calcium supply in the body, the dentist prescribes, and is being urged to prescribe, preparations containing calcium and phosphorus. One cannot speak of calcification or the laying down of bone, dentin or enamel without at least mentioning the endocrine system, and particularly that part related to the parathyroid and its function in calcium deposition. The parathyroid gland alone does not appear to be associated with dental abnormalities. Investigations on record, confirmed and unconfirmed, point to an interplay of other glandular functions.

These points are cited to illustrate the classes of drugs that dentists may be expected to prescribe, recommend or give advice on.

The advertising for many proprietary drug products sent to dentists compares in volume with that sent to physicians. Promoters of nostrums and proprietary pharmaceutics have long endeavored to use the dentist as an advertising medium for the exploitation of such products. This has been particularly true of analgesic and anodynic preparations, so-called "mouth washes" and, in our own day, of calcium compounds. Space does not permit discussion of the expenditure of millions of dollars for extravagant advertising of dentifrices, and the efforts of some of these advertisers to envelop the dental profession in their sometimes questionable policies.

Several years ago, an advertising manager for one of the more reputable drug houses stated in effect that the dentist had done more than his share in starting many an unknown proprietary on its road to fame and fortune. Dentists are beginning to appreciate how they have unwittingly helped to increase the sales of mouth washes, dishonestly manufactured and advertised dentifrices and pocket-size packages of pain relievers. The last class of products is claimed to relieve the pain due to toothache and that due to menstrual and other disorders, and by distributing these packages to

their patients, the dentist innocently helped to promote the undesirable habit of self-medication. Dentists now voice their disapproval of these practices that impose on their confidence and are antagonistic to the public welfare. Dentists are appreciative of any movement whereby they can help overcome these evils.

The Council on Dental Therapeutics is not unmindful of the fact that there are many manufacturers of pharmaceutic and other products used by the dentist whose scientific and merchandizing policies have added much to the dental armamentarium. The practices of these manufacturers permit the belief that drugs can be sold without recourse to deceit and trickery. These the dental profession, as well as the pharmaceutic profession, should encourage.

There unfortunately seems to be a wide-spread tendency on the part of the American public to the practice of self-medication. Space does not permit a full discussion of the evils inherent in this practice, but one or two aspects may be mentioned. A study by Rorem and Fischelis, of the Committee on the Cost of Medical Care, has revealed that the annual medicine bill of this country is $715,000,000. Of this amount, approximately $360,000,000, or 50 per cent, is expended by the public for "patent medicines," exceeding the amount spent for physicians' prescriptions and home remedies. This fact invites the attention of the dental, pharmaceutic and medical professions to some of the evils of proprietary and nostrum exploitation. But even vastly more important than this unnecessary and uneconomic outlay of the public's money is the detriment, sometimes permanent, to the health of the individual who practices self-medication. Thus, through a sense of false security, scientific dental, medical and nursing treatment, readily available, and which, if provided in time, might have prevented irreparable damage or fatal termination from disease, is not secured.

Many clinical samples are sent to dentists by manufacturers of all kinds, good and bad. The idea is palpable. Many of them do not expect a clinical test in the fine sense of that term, but they do hope that the package will be used and displayed in such a way that the patient remembers the name after he leaves the office, and thus that it may be purchased, without the immediate advice of his medical adviser, for treatment of similar conditions that may develop after the original visit.

Contrary, undoubtedly, to the desires of the manufacturers of nostrums and some pernicious proprietary articles, who would have the dentist display to his patients samples and literature of such products sent to him as clinical samples, it is gratifying to know that since the inception of the Bureau of Chemistry and the Council on Dental Therapeutics in the American Dental Association, the dental profession, by and large, are protesting these evil practices and supporting the interests of legitimate therapy as expressed in the reports of the Council.

The protests of members of the dental profession against such subversive influences in dental therapy became so great that, in 1928, there was established in the American Dental Association, a bureau of chemistry to investigate the chemical composition of these secret proprietaries, and, in 1930, a council on dental therapeutics, whose broad object is to protect the dental profession and the public against fraud or imposition, undesirable secrecy and objectionable advertising in connection with the marketing of proprietary dental articles.

The findings of the American Dental Association Council were indeed star-

tling, but not unexepected to those acquainted with existing conditions. These findings aroused dentists to a recognition of this degrading misuse of their confidence. A few examples of the findings may be cited. A "cure" for almost all the diseases of the hard and soft tissues was found to be nothing more than a dilute solution of trisodium phosphate. Tooth bleaches, largely used by the public, were found to be composed mainly of hydrochloric acid. The "newest local anesthetic" was found to be mainly a mixture of nothing more than chloroform and benzyl alcohol. A pyorrhea "cure" was found to be compound tincture of benzoin, to which was added a little zinc chloride. Another pyorrhea "cure," 20 c.c. of which sold for $10, was found to be nothing more than 40 per cent sulphuric acid, and Vleminckx' solution was redressed in a therapeutically suggestive name, and sold at an exorbitant price to dentists as a pyorrhea "cure."

When these facts were made known to the profession, the members were of course aroused, and gradually, by a campaign of education along these and other lines, they are being made aware that all the drugs needed for the intelligent practice of dentistry, with few exceptions, may be found in the U. S. Pharmacopeia or the National Formulary.

The Council on Dental Therapeutics also appreciated that while the dental curriculum included a discussion of official drugs and their usage, the commercial forces at work against rational prescribing were great and could be overcome by a campaign of education. Accordingly, the Council has continued to give the profession frank and unbiased information on proprietary medicines advertised to the dentist and the public, and has pointed out the usefulness of official drugs. The Council has published a number of general articles on pharmacology and therapeutics, such as "Uses and Abuses of Barbitals," "Diet and Teeth" and "Intravenous Medication," and other articles discussing the evidence available in disputed fields relating to dental therapy.

It has also undertaken the preparation of a small volume which will list acceptable and useful dental remedies with a description of their properties, actions and dosages. This little volume will list both official and nonofficial drugs, regardless of source, origin or affiliations. The material, which is now appearing in serial form in THE JOURNAL, will be collected later between two covers. It is hoped that this volume may serve as a useful means of restricting the materia medica of dentistry to reasonable proportions, and that it may be of value to dental practitioners, students and teachers of pharmacology and therapeutics. It is not intended that such a book will take the place of courses in pharmacology and therapeutics. Its purpose is to serve as a guide in the selection of agents that may be worthy of further and intensive study. Such a book should be particularly useful to practitioners as a ready reference, and a guide to old and new remedies. It may also be useful to pharmacists as a basis for a consideration of problems common to pharmacy and dentistry.

Certain members of the profession of pharmacy have been confronted with problems not entirely unrelated to those just discussed. The widespread use of proprietary remedies, which was in marked violation of the rational practice of pharmacy and therapeutics, was a cause of grave concern to thinking members of the pharmaceutic profession. These abuses were, in a measure, responsible for the devolution of the pharmacy from a strictly professional medium concerned with the study and preparation of drugs to the now common gen-

eral-drug-soda-beer and variety store whose only reason for existence is purely commercial. This has been a source of irritation to those who see pharmacy as a profession no less respected than other professions and whose aims and ideals are based on service. It is gratifying to know that scientific pharmacies operated according to the best traditions of that profession are increasing throughout the country. Such pharmacies deserve encouragement from both members of the healing professions and pharmacists who hold their calling high.

This support should be more than moral. It presupposes an active campaign on the part of pharmacy, if prescriptions are to be written and filled. The specialty manufacturer uses every tool known to advertising to persuade the prescriber to use the specialty in preference to the official product. Pharmacy should do its part in inducing the healing professions to restrict their prescriptions to official products.

Pharmacists belonging to this class have much useful information which they can place at the disposal of the dental profession. An incident will serve to illustrate this fact. Sometime ago, there appeared in one of the dental journals a suggested method for the treatment of Vincent's infection by the use of "bismuth tartrate emulsion," presumably prepared by a pharmacist. To one with a knowledge of the Pharmacopeia or the National Formulary, it was evident that bismuth tartrate was not described. A competent pharmacist would have advised the writer of the aforementioned article that the drug was nonexistent in an official sense, and might have suggested an equivalent preparation in terms of an official drug, or an acceptable nonofficial drug. Thus, there would have been prevented the addition, to therapeutic literature, of an unnecessary preparation, and the flood of inquiries concerning the source of such a preparation would have been avoided. The properly informed pharmacist can suggest official preparations in lieu of the fad of the day.

Reference has already been made to the circumstance that certain nostrum and proprietary exploiters have attempted to place rational medical and dental therapeutics in an unfavorable position. The Council had occasion to declare as unacceptable a product that was composed essentially of 98 per cent salt, and small amounts of calcium oxide, ammonium carbonate, congo red and phenolphthalein, saccharin and aromatics. In the course of correspondence, the president of the company handling this product, who, incidentally, was connected with a large advertising house, wrote:

> And we know also that it is not practical to give the prescription for —— to a patient to have put up in a drug store anymore than it is practical to give the patient a prescription for even a simple tooth paste with the expectation that the average druggist would put it up uniformly.

One cannot but feel that the statement was prompted by the expectancy of a larger profit from putting up salt in a fancy bottle than if it were purchased under its well-known name. The writer of the letter was informed of our disagreement, and that the statement contained a very grave and unjust reflection on the profession of pharmacy. The question may still be raised as to whether pharmacy itself is not partly responsible for this attitude. Too often, it has failed to condemn concretely proprietary products which violated pharmaceutic and therapeutic decency.

The efforts of some pharmaceutic educators are encouraging. Shortly after the work of the Council started, Dean Schicks, of Rutgers University College of Pharmacy, became acquainted with

the circumstance that pharmacists were overlooking a fruitful field of cooperation with the dental profession. Study showed that there are many drugs and pharmaceutic preparations which are employed in the practice of dental therapeutics in the office and by the patient at home. The failure of the pharmacist to make known his ability to serve dentists, coupled with the assaults of some unprincipled proprietary medicine firms, has left an open field for other agencies to offer that which the pharmacist is best equipped and trained to provide. Since representatives of dental supply houses and pharmaceutic firms find it profitable to detail dentists frequently, why should not pharmacists follow the same plan in order to increase their usefulness?

In order to develop a closer relationship between the professions of pharmacy and dentistry, several suggestions might be made: The pharmacist should concern himself with the purity and quality of his drugs, and with accurate compounding of prescriptions. He should recommend to the dentist and physician that they increase their use of drugs official in the U. S. Pharmacopeia and National Formulary and the recognized nonofficial books of standards, since these are the drugs of which the dental, medical and pharmaceutic professions have determined the therapeutic usefulness; and he should discourage the use of fraudulent and secret remedies. The fact that the U.S.P. drugs are used with so little advertising in contrast with the millions of dollars spent in promoting the sale of proprietary drugs is testimony to the worthwhileness of such a campaign.

Thinking pharmacists will recognize that they cannot properly serve the interests of public health or the maintenance of high professional ideals and standards if pharmacy condones counter prescribing and does not speak openly against those products marketed contrary to the interests of the public. It is true that pharmacy has spoken against this evil in general terms, but one wonders if the time has not come to substitute the specific and the practical for the general and the futile. Conversely, no thinking member of the dental profession can lend himself and his profession to the schemes of exploiters of nostrums and unscientific pharmaceutic preparations. He cannot, through testimonials for such products, or through reference to such in contributions to dental literature, give endorsement to drugs or preparations adequate scientific evidence of whose usefulness is not available. Official dental organization periodicals fail to meet their moral and high professional responsibilities to the public and to their profession if they advertise such preparations. The same holds true for pharmaceutic periodicals.

Local and state dental societies similarly fail to meet such obligations if they include in their commercial exhibits this type of preparation. In the past, instances have occurred wherein undesirable products were included in both the advertising copy and exhibits of dental organizations on the basis of revenue obtainable; while, at the same time, the truly scientific members of the same organizations were refusing to use or prescribe these articles. It is realized that such undesirable practices are becoming rarer, and that future standards will, in a large degree, be dependent on organized dentistry's educational efforts in this direction.

The work of the Council on Dental Therapeutics is becoming more firmly established, despite the open or secret opposition of commercially minded persons in the profession, and portends cooperation between pharmacist and dentist. Indeed, the pharmacist occupies an essential place in any campaign looking toward the more rational use of drugs.

Several aspects of the relation of therapeutic reform to the wider field of dental affairs have been omitted from this discussion. Closely allied to the proprietary medicine problem in dentistry are the problems of dental education and dental journalism.

In that monumental work "Dental Education in the United States and Canada," William J. Gies pointed out more definitely than had any of his predecessors the need and desirability of an investigative body such as the Council on Dental Therapeutics. Dental education could not be complete, Dr. Gies contended, unless the American Dental Association undertook certain functions, which have since been expressed in the work of the Council, as an educational obligation to its members. As forcefully as he used his pen in the interests of better dental education years ago, Dr. Gies pointed out the questionable influence of its commercially subsidized journalism.

Dentistry, like other professions, suffers from those journals which violate the highest ideals of each of these professions. Some of these journals, ostensibly published in the interests of the professions, are nothing more than mediums for the purpose of obtaining revenue. The uncritical acceptance of advertising of unworthy products is too well known to require comment. The American College of Dentists has attacked this evil in dentistry at its source. The report of its Commission on Journalism has brought into the open many subversive practices. It has shown the close connection between legitimate journalism and therapeutic reform. It has not been content with critical comment, but, by precept and example, it is pointing out to dentists how the forces of advertising which exploit the profession in respect to undesirable proprietaries and nostrums, can be met.

Another important factor in the whole situation is represented in dental education. The American Association of Dental Schools has recently organized a section on materia medica and pharmacology, which gives every indication of growing into one of the liveliest sections. This, it is hoped, will be reflected in the survey of dental curriculums now underway. Writers of textbooks on dentistry are beginning to be influenced by the Council's reports and several urge the use of only acceptable products.

Paul J. Hanzlik, professor of pharmacology, Stanford Univeristy School of Medicine, a member of the Council on Dental Therapeutics, after reviewing the circumstances which led to the formation of these educational bodies in the dental and medical professions, aptly asked: "What may be expected of a therapeutics which acts in definite terms of the remedy and conforms to the operation of laws controlling biologic phenomena in disease? Briefly, the answer is accuracy, dependability, safety, justice and success. The converse of all this is to be laid at the door of guesswork and ignorance."

Pharmacists and dentists can cooperate to bring about this system of therapeutics which Professor Hanzlik points out as leading to accuracy, dependability, safety, justice and success.

THE TESTED FUNCTIONAL IMPRESSION AS A POSITIVE MEANS FOR DETERMINING MAXIMUM SURFACE EXTENSION AND CORRECT PERIPHERAL OUTLINE FORM FOR FULL DENTURE BASES*

By R. O. SCHLOSSER, D.D.S., F.A.C.D., Chicago, Ill.

A STUDY of the contemporary literature dealing with the subject of impression taking as it pertains to full denture prosthesis will reveal many variations in technic and some diversification in the choice of impression materials; yet basically the objective striven for remains ever the same; namely, the obtaining of a surface and peripheral formation that will most adequately serve as a perfect pattern for a denture base.

This fact prompts me to ask the following question: What are the requisites in the form of a denture base for maximum stability and retention, or resistance to displacement forces, which will insure the greatest possible comfort to the supporting tissues as well as minimize the unfavorable changes in these and adjacent structures?

It is at all times easier to ask questions than to answer them satisfactorily; yet in formulating the foregoing, rather lengthy question, I held the belief that, in its composite form, it embodied the essential points about which many inquiries are made by those members of our profession who are particularly interested in full denture work and are devoting a major portion of their time and effort to finding means and methods for solving this and kindred problems.

It is my plan not only to give you an answer to this question, but also to present some specific data gained from years of personal study and clinical experience upon which I shall base the conclusion arrived at.

Hans Rehm,[1] of Berlin, in an article on impression methods for edentulous jaws, begins by saying that while much has been written in dental literature in his country as well as abroad, he feels that the almost innumerable contributions, because of the indistinct and often complex manner in which they have been presented, constitute a real danger to the general practitioner and in the end but confuse him.

A. Brunnetti,[2] of Bologna, writing about partial vacuums, etc., makes reference to the incorrect usage by dental authors of the terms "cohesion," "adhesion," "capillary attraction" and "atmospheric pressure." He laments that in spite of the knowledge that these terms have long received proper affixation in

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 8, 1933.

1. Rehm, Hans: Impression Procedures for Edentulous Upper and Lower Jaws, Fortschr. d. Zahnheilk., 7, No. 1, 1931.

2. Brunnetti, A.: Researches in Re Occurrence of Partial Vacuums in Space Between Plate Dentures and Mucosa, Ztschr. f. Stomatol. 28:116, 1930.

the lexicon of theoretical physics, this continues true.

Those of us who have been readers of the editorials in THE JOURNAL during the past decade will recall the reference[3] made a few years ago to the great confusion, bordering on a state of chaos, existing in the realm of full denture prosthesis. These three specific articles[4] are cited here to partially substantiate the first part of my opening paragraph. Further evidence of the truth of these statements may be gained from the accompanying references.

My answer to the question as given in my second paragraph is as follows:

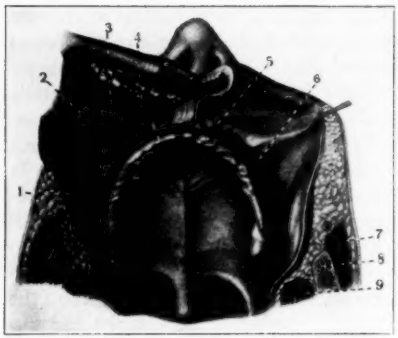

Fig. 1.—Edentulous maxilla and associated musculature. *1*, buccinator muscle. *2*, M. caninus or levator and depressor labii superioris, upper and lower portion, before which may be seen the region of the lateral frenum filled with fatty and loose connective tissues. *3*, orbicularis oris muscle. *4*, M. incisivus labii superioris, levator and depressor. *5*, anterior ridge of the incisivus labii superioris visible through the mucous membrane. *6*, lateral or buccal frenum. *7*, masseter muscle. *8*, mandible. *9*, internal pterygoid.

The requisites of a denture base are: an intimate adaptation to the supporting tissue surfaces plus a correct peripheral formation; these to be developed during the act of taking the impression and its subsequent treatment, with a full consideration of all biologic factors involved.

Under biologic factors, we quite naturally include the histologic, the anatomic and the physiologic as far as they pertain to the structural form, health and function of the hard and soft tissues forming the vault and ridges along with the attached and related muscular and connective tissue structures and their blood and nerve supply.

The basic thought which prompted me to discuss this particular phase of impression work lies in the fact that whether it be due to the above-mentioned confusion, or to some other fact, there seems to be among many in our profession a rather gross misconception of the true value of functional impression methods; while others consider it a most difficult and time-consuming procedure. A third group have, in what to me seems an apparent state of utter indifference, accepted quite freely the generous contributions of the purveyors of gum tragacanth or similar

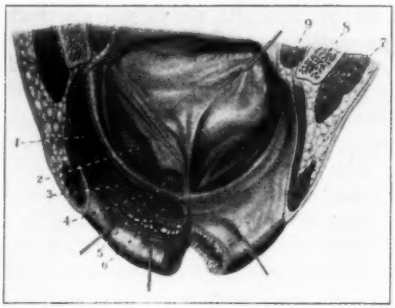

Fig. 2.—Edentulous mandible and associated musculature. *1*, buccinator muscle. *2*, M. mylohyoid. *3*, M. orbicularis. *4*, M. incisivus labii inferioris. *5*, M. genioglossus. *6*, M. mentalis or levator labii inferioris. *7*, M. masseter. *8*, mandible. *9*, M. internal pterygoid.

3. Editorial, J.A.D.A., 12:738 (June) 1925.
4. Footnotes 1-3.

preparations under the various trade names, as an aid in solving their problems of denture retention. I am fully cognizant of the oft heard plea that what we need in this, as in other phases of dental work, is a simplification of technical procedures; yet all this has not as yet convinced me that simplicity of the technic by itself is now, ever was or should be recognized as the keystone of success in any professional undertaking.

In order that we might better comprehend the full significance of the relation of oral anatomy to impression taking, I have had several slides made of illustrations accompanying an article by Stephan Loos,[5] of Vienna.

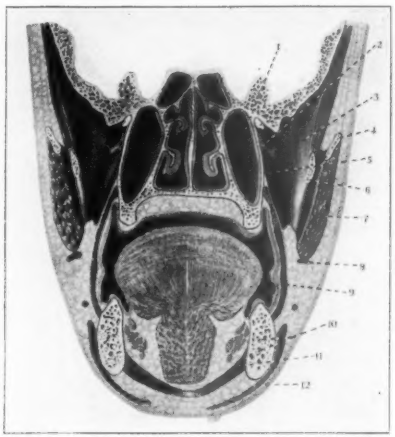

Fig. 3.—Frontal cross-section showing completely edentulous maxillary and mandibular ridges and associated structures. *1,* maxillary sinus. *2,* maxillary nerve and artery. *3,* temporal muscle. *4,* cut surface of zygomatic arch. *5,* external pterygoid muscle. *6,* coronoid process of mandible. *7,* masseter muscle. *8,* parotid duct. *9,* buccinator muscle. *10,* mandible with inferior alveolar vein and nerve. *11,* mylohyoid muscle. *12,* platisma muscle.

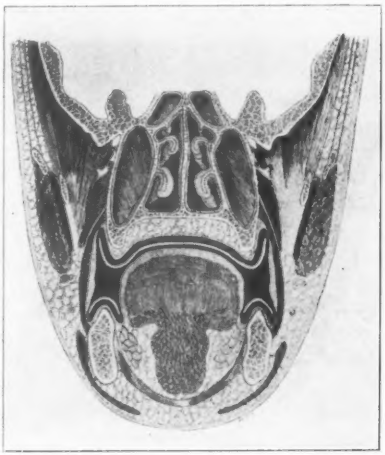

Fig. 4.—Frontal cross-section of completely edentulous ridges and associated structures showing maxillary and mandibular functional impressions of modeling compound in their relation to oral musculature.

Figure 1 shows an edentulous maxillary ridge and other related structures. The lower portion of the head has been removed, the mandible has been sawed through and the mucosa on the right side has been so prepared as to permit the underlying musculature to be exposed to view. The structures seen are: *1,* buccinator muscle; *2,* m. caninus or levator and depressor labii superioris, upper and lower portion, before which may be seen the region of the lateral frenum filled with fatty and loose connective tissues; *3,* orbicularis oris muscle; *4,* m. incisivus labii superioris, levator and depressor; *5,* anterior ridge of the incisivus labii superioris visible through the mucous membrane; *6,* lateral or buccal frenum; *7,* masseter muscle; *8,* mandible; *9,* internal pterygoid muscle.

Figure 2 shows the mandibular section of the same specimen. The right side has been prepared in a similar manner

5. Loos, Stephan: A Contribution to Anatomy of Oral Cavity and to Impression Technic for Full Dentures. Ztschr. f. Stomatol., 29:1-25 (Jan.) 1931.

to afford a better view of the various structures. The lips are drawn firmly downward while the tongue is drawn very firmly upward. The muscles shown are: *1*, the buccinator; *2*, mylohyoid; *3*, orbicularis; *4*, incisivus labii inferioris; *5*, genioglossus; *6*, mentalis or levator labii inferioris; *7*, masseter, and *9*, internal pterygoid. Section of the mandible is shown at *8*.

Figure 3 is a view of a frontal cross-sectional cut through the head, not quite vertical. The structures portrayed are: *1*, the maxillary sinus; *2*, maxillary artery, vein and nerve, second branch; *3*, temporal muscle; *4*, cut surface of the zygomatic arch; *5*, the fibers of the external pterygoid, lying deeply; *6*, the coronoid process of the mandible, partially cut into; *7*, masseter muscle; *8*, a cut through the parotid duct; *9*, buccinator muscle, and *10*, the mandible, showing the third branch of the nerve and the vein.

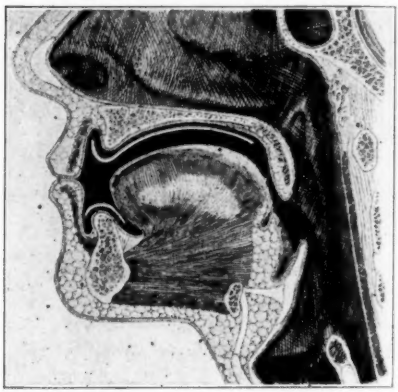

Fig. 5.—Sagittal cross-section of completely edentulous ridges and associated structures showing functional modeling compound impressions in situ and their relation to oral musculature.

It is my belief that these illustrations are quite the best to be found anywhere showing the anatomic structure of an edentulous mouth. It seems fitting to devote time to a brief review of the physiology of these and associated structures, because of the direct bearing this has on the main points in this paper. The functions of these muscles are as follows: The buccinator compresses and contracts the cheeks and retracts the angles of the mouth.

The levator and depressor angulioris muscles, as their name implies, raise, retract and depress the angle of the mouth.

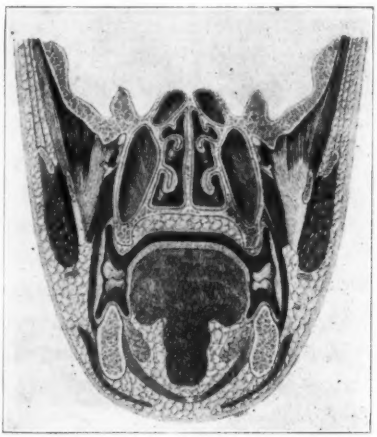

Fig. 6.—Frontal cross-section of complete dentures patterned after functionally adapted impressions as shown in Figure 4, depicting relation of finished dentures to musculature of oral cavity proper, the buccal vestibula and supporting mucosa of ridges.

The orbicularis oris muscle closes the lips. The incisivus or levator labii superioris lifts and protrudes the upper lip, while the levator labii inferioris raises the lower lip and wrinkles the chin.

The depressor labii inferioris lowers the lip and also depresses the angles of the mouth.

The internal pterygoid raises the mandible and draws it forward and in the lateral movement it is assisted by the external pterygoid muscle.

The mylohoid elevates the hyoid bone and aids in depressing the mandible.

The genioglossus retracts, depresses and protrudes the tongue and raises the hyoid bone.

The geniohyoideus lifts and advances the hyoid, and aids in depressing the mandible.

The masseter elevates the mandible.

The temporal muscles draw the condyles back in their sockets from forward and lateral protrusive positions. The labial, buccal and lingual frenulums are membranous folds that check or limit the movements of the lips, cheek and tongue, yet during function their movements are varied and they must receive proper attention during impression taking.

This review will help you to grasp what I referred to when saying that we must give proper consideration to biologic factors. Particularly as we desire to comply with all functional requirements is it a basic necessity that we be familiar with the anatomy and physiology of the structures on which we depend in part for the support, retention and tolerance of the artificial dentures.

Needless to say, we should be able to differentiate in our diagnosis between resilient, nonresilient, loose connective and spongy or flabby tissues. We should be able to distinguish between alveolar gingiva and the movable tissues which go to form the fornix vestibula when we undertake to develop the form of the denture periphery.

I recently[6] made reference to the functional impression methods as taught and practiced in various European countries. Hans Rehm defines the functional impression as "one taken with individually prepared trays that have been carefully contoured in conformity to the arch, vault and ridge form, and taken with closed mouth conditions under masticatory stress and with the aid of the active or passive movements of the cheeks, lips, and tongue." Rehm further states that this type of impression is especially indicated for cases in which there has been much absorption of the alveolar ridges and for those having extremely flat vaults. He, too, stresses the need for ascertaining what the consistency of the mucosa is, and, according to his findings, he varies his choice of impression material, using by preference modeling compound or guttapercha for cases exhibiting marked resilience, flabbiness or extensive loose movable tissues. For the cases showing marked tissue atrophy or nonresilience, he employs plaster of Paris, preferably in conjunction with a specially prepared tray made of shellac baseplate material to which occlusal rims are attached. It will be seen that, in principle, the method is quite similar to the methods that have been in use in this country since the days of the Greene brothers, Giffen, Tench and Supplee. These methods have been so often described that it would be superfluous for me to cite them in detail. There are certain phases that can be discussed to our mutual benefit. They are the ones suggested in the title of this paper.

The technic calls for preliminary modeling compound impressions, into which study models of plaster of Paris are cast. Over these the soft metal trays are shaped and fitted with occlusal rims. While in perfect agreement with Dr. Rehm and others as to the indications for the use of plaster for certain types of cases, I shall confine myself to a description of the method employing modeling

6. Schlosser, R. O.: D. Cosmos, 75:39 (Jan.) 1933.

compound. In the work that I have done with this material in more than twenty years, I have recognized that, during impression taking, there is a definite reciprocal action between the tissues against which the material is being pressed and the material itself. This is due in part to the inherent qualities and varying consistency of the mucosa and associated tissue structures and in part to the inherent properties of this type of impression material. Lastly, it is due to the control exercised by the operator over the plasticity and flow of the impression mass as well as to his ability to effect a proper placement of the various tissues during the act of impression taking.

My contention is that the operator who has a thorough understanding of these fundamentals (and this means also the ability to diagnose correctly the mouth conditions) can, because he has a conception of what the physiologic requirements of good dentures are, develop his impressions in compliance therewith.

Knowing which muscles are involved and being familiar with the position of their attachments and particular function, the operator so shapes his trays as to allow for unhampered muscular movements. The required amount of impression material, after being attached to the maxillary tray, is so formed that the displacement of air, the proper placement of displaceable tissue and the more or less uniform distribution of the modeling compound are facilitated. The surface of the impression mass that is to come in contact with the denture supporting tissues is brought to a desired state of plasticity and the temperature kept under control so that it will not exceed the tissue tolerance. At this stage, the tray is introduced and, by proper manipulation, the material is pressed upward against the vault and ridges, and inward against the labial and buccal surfaces thereof, the base impression being thus developed.

It is during this procedure that the reciprocal action previously referred to takes place, resulting in giving us that intimate surface adaptation to the stress-bearing areas. The impression material is allowed to harden, after which any surplus is trimmed from the peripheral mass. The impression is checked for proper extension along the palatal border and if found to extend beyond the "ah" line, it is trimmed to eliminate the overextensions. The proof that the underlying mucosa has been properly placed and is not overcompressed is found in the stability of the impression and failure to note any displacement of it and in the absence of discomfort on the part of the patient. At this stage, no attempt is made to have the patient dislodge the impression by muscular movement.

The next step is the development of a good occlusion. In fully edentulous patients, this is accomplished by bringing the occlusal surfaces of the opposing rims into contact, by first softening the mandibular rim and allowing the patient, by elevating the mandible, to bring it against the maxillary rim and then allowing the compound to harden. It is necessary that the base of the mandibular tray preparation be properly fitted to the lower ridge previously. The occlusion should now be checked for balance. A lack of balance will cause a displacement of the bases and consequently interfere with the proper development of the final form of the impression flanges. Correction may be effected by reheating the surface of one rim and having the patient repeat the closure. Owing to some interference, it is occasionally necessary to build the rims up in order to obtain better occlusion. When the patient can bring the rims into contact and apply firm masticatory stress without dislodging the upper base impression, the occlusion may be

judged to be properly balanced. This occlusion need not be in centric relation, nor is it required that it shall register accurately the acceptable vertical dimension of the denture space, though we grant better muscle action may be had when the relation approximates the normal. These details are to be taken care of at a later step. It functions primarily as a convenient means of supporting the base impression and maintaining its stability during the procedure of remolding the buccal and labial flanges of the maxillary impression in conformity with correct extension and peripheral adaptation.

The flanges are now reheated by sections. As this has been described in Clapp and Tench's[7] work as well as in the fourth edition of Prothero's "Prosthetic Dentistry,"[8] it need not be repeated here except to point out that when these areas of the impression are reheated and then subjected to the various muscular tensions, the extension as well as the peripheral form are automatically worked out, and because the tissues are kept under tension until the modeling compound has again hardened, there is no reexpansion possible. In consequence, tissue compression is present only when masticatory force or its equivalent is applied, being absent at all other times. Full freedom for the frenula is also assured. This permits these attachments to continue their functions normally, and obviates having them modified by surgical intervention.

In all, there are but five steps of closed mouth muscular action employed to reduce the height of the buccal and labial flanges of the maxillary impression and develop their correct adaptation and peripheral form. In addition to these, there is one muscular movement executed while the mouth is open; namely, the forceful downward pull of the upper lip. This action draws the labial frenum down, and is used to cut a notch in this region of the labial flange that will insure the fullest freedom for this attachment subsequently when the completed denture is placed. The reason for keeping the mouth open for this action lies in the fact that it cannot be properly performed when the mouth is closed. In lieu of the occlusion, the operator holds the impression in place by applying firm upward pressure during the operation.

Because of the movement of the soft palate which takes place during speech and deglutition, there is a tendency for this tissue to pull away from the postpalatal border of the maxillary denture, causing, owing to the intermittent break of the peripheral contact, a tickling sensation, which induces nausea. This is not always due to an overextension, as some believe, but rather to an insufficiently intimate surface adaptation. It is the purpose of the postdam to correct this condition. After the impression has been extended posteriorly to the line of flexion or the "ah" line, the magnitude of the tissue yield is ascertained and a surface addition is made with soft black carding wax. The thickness of this addition should not exceed two thirds of the tissue yield, lest it cause overcompression, with subsequent atrophy. Not only does a properly applied postdam guard against nausea, but it also insures the maintenance of the peripheral seal during function. While those using various types of wax or guttapercha, as for a lining impression, also aim to develop relief areas by allowing the impression to remain in the mouth sufficiently long, I

7. Clapp, G. W., and Tench, R. W.: Professional Denture Service, New York: Dentists' Supply Co., Vols. 1 and 2, 1921.

8. Schlosser, R. O.: Contribution to Prothero, J. H.: Prosthetic Dentistry, Chicago Medico-Dental Publishing Co., Ed. 4, 1928, pp. 521-547.

develop these areas by scraping the impression.

Let us next give our attention to the mandibular impression. Lest I lay myself liable to criticism, I will state that, for this impression, the physiologic action is primarily employed to affect a correct surface adaptation, while the matter of extension and peripheral formation are taken care of by means of knife trimming and peripheral corrections. These are, of course, dependent in large measure on proper diagnosis.

Here, as in the case of the maxillary impression, we begin by taking a preliminary impression, pouring a study cast and selecting a suitable tray and preparing it to comply with the individual requirements. The prepared tray consists of a modeling compound base of from 2 to 3 mm. thickness, reinforced by a metal tray of the Giffen-Kerr type, and fitted with an occlusal rim. The compound base should be made to conform to the arch form and ridge contour. This can best be accomplished by heating the tissue side or surface slightly and pressing it gently against these tissues of the ridges. When the compound has hardened, it should be again placed on the ridge to determine whether it can be firmly pressed against the tissues without causing discomfort to the patient. Next, the occlusion is developed and checked as in the case for the maxillary impression; after which the periphery of the base is so trimmed that it is sufficiently underextended to insure full freedom for all muscular action. When natural maxillary teeth or an artificial denture is present, the mandibular rim is occluded with these.

A lining of 2 to 3 mm. of softened modeling compound is now attached to the inner surface of the prepared base, and so distributed as to thin out the central or ridge portion, and thicken and elongate the peripheral portions. This is done that when the tray is placed, the periphery of the impression mass, as formed, will make the initial contact with the tissues at the base of the alveolar ridge, the patient then being asked to close the mouth, elevate the mandible and bring the rims into occlusion under the guidance of the operator. He is next told to keep the mouth closed, to suck, contract the lips and cheeks, and swallow, and to repeat this action a number of times, after which the modeling compound is allowed to harden. This combined action brings into play virtually all the muscles which were illustrated in the accompanying illustrations. As a result of the individual tray preparation, good occlusion, correct distribution and consistency of the impression material, plus the free and full muscular action, a surface adaptation to the tissues that is positively intimate is obtained. Yet because they were given ample opportunity to assume all proper positions conceivable, and by their very tension and movements were allowed to mold the plastic material to their own functional requirement, we know that the resultant surface formation will not overcompress or wrongly place the denture supporting tissues. Again, the tension ceases when the occlusal surfaces are separated and, in consequence, there can be no strangulation of tissues.

When the modeling compound has hardened, the lingual and vestibular overextensions are carefully trimmed off with a knife. It is here that a careful notation of the position of muscular attachments along the alveolar border will assist the operator in determining just what constitutes excess. Certain operators endeavor to apply open mouth muscular movements for this purpose instead of the knife trim. This procedure most often results in a severe distortion and loss of adaptation, and, in disgust, many opera-

tors, at this stage, resort to a hasty plaster wash. (For those who find it difficult to master the compound technic, I would suggest the use of vulcanite trays or trial dentures with the lining of oxide zinc impression paste or similar material.)

Those using guttapercha develop their base impressions very much as we do ours with the modeling compound. After trimming off the surplus, they make many additions to the defective areas and subject the impression to further functional action, repeating the additions and corrections until they are satisfied that they have maximum extensions with functional freedom; which sometimes requires hours or days.

It is our belief that even in those cases usually considered quite difficult, it is possible to attain a maximum of stability and resistance to displacement with the technic as outlined, in a comparatively short time.

It is advisable, when trimming off the peripheral surplus, not to trim too close. In other words, particularly in cases of small narrow ridges, it is well to leave the impression slightly overextended, then to check it to see whether it may be tolerated. Such overextensions, when they can be tolerated, because of even a slight increase of the denture area give increased retention. Most mandibular impressions developed under functional stress exhibit marked stability and resistance to certain displacement forces, yet it is usually found that, at their posterior termination, the peripheral contact is not sufficiently intimate to constitute a perfect seal. A pressure applied to the occlusal rim in the incisor region, in a downward and forward direction readily causes the impression to be displaced. To perfect the peripheral seal, it is but necessary to make a slight surface addition, this being best accomplished with tracing stick compound. This technic was ably demonstrated by R. W. Tench,[9] fifteen years ago. It is amply described in the fourth edition of Prothero's "Prosthetic Dentistry." The correction is made under open mouth conditions, permitting the addition to be molded against the tissues in the region of the retromolar triangle areas, while the adjacent movable tissues are distended as in yawning. This adaptation in no way impinges on the tissues when the mouth is closed, but does intensify the resistance toward dislodgment when stress is applied to incise food. Should the lingual or vestibular peripheral border show some slight defects, these may be corrected by making small additions to these defective areas, again subjecting them to closed mouth muscular action. When, for some reason, the defects are more extensive and the impression base lacks stability, it is but necessary to again reline and repeat the foregoing procedure.

CONCLUSION

The functional impression technic as described herein permits the operator to procure a perfect surface adaptation, provides the means of developing maximum extension, and peripheral form for the bases of maxillary dentures, insures, through the control exercised by the operator, a proper placement of the supporting tissues of both ridges and, in conjunction with the judicious use of a sharp knife, also develops the correct surface pattern for the mandibular denture base in strict conformity with biologic requirements.

While I favor this functional impres-

9. Tench, R. W.: Afterthoughts Concerning Impressions for Full Dentures, J.A.D.A., 15:37 (Jan.) 1928.

sion method and prefer to use modeling compound in most cases, having employed this method and material successfully for many years, I fully appreciate that other materials and technics have been and are being used, and when properly applied, they may be depended on to give good results. The indications for varying the choice of methods and impression materials I recently treated quite fully at the meeting of the Maryland State Dental Association.

SO-CALLED DRY SOCKET*

By GLENN J. PELL, D.D.S., F.A.C.D., Indianapolis, Ind.

THIS question is considered of minor importance by many authors, and little research work on it has been done by the profession. Almost every dentist treats the condition empirically with his favorite remedy, which may be anything from strong cauterants to a friendly slap on the back with the admonition to return the next day if it is not better. But those of us who have the welfare and comfort of the patient at heart cannot lightly consider the problem when the patient finally turns to us for relief.

It is my opinion that the socket is in a state of sepsis produced by the action of saprogenic and zymogenic organisms, and as soon as this septic condition is overcome by treatment, the socket is on the way to repair.

There are many local conditions that may in a measure predispose to this condition:

1. The presence of pulpless teeth with root-canal fillings, which is usually accompanied by atrophic changes in the peridental membrane, with resultant decrease in blood supply and partial ankylosis. Extraction of these teeth causes greater trauma to the bony wall of the socket.

2. Condensing osteitis, which also contributes to the difficulty of removal, and means a diminished blood supply.

3. Rarefying osteitis, which is a factor because of the pathologic process present.

There are also other conditions that must be considered. Undue trauma to contiguous tissue, failure to remove fractured spicules or cuttings of bone and failure to remove granulomatous or granulation tissue at the time of operation. These conditions cause increased irritation and decreased resistance to invading organisms.

Injudicious curettage, or trauma to bony walls in removing granulomatous or granulation tissue, or, may I say, the scraping of bone that should not be injured or inoculated with the organisms present in the process of this scraping only adds insult to injury and, in many instances, interferes with repair.

When, in the removal of fractured or broken-off roots in tedious cases or in curettage, we work beyond the bleeding and clotting time, frequently sponging the cavity with gauze, coagulum is formed in the ends of all broken blood

*Read at the fifteenth annual meeting of the American Society of Oral Surgeons and Exodontists, Chicago, Ill., Aug. 4, 1933.

vessels. Thus, when we are finished, there is not normal bleeding to fill and protect the cavity. The bleeding time is somewhat prolonged when using an aspirator. It is my judgment that cotton should never be used in bone crypts because the fibers catch and remain as foreign matter.

The commonly used percentage of vasoconstricting agent in procaine solutions may slightly interfere with the blood supply to the part in supraperiosteal anesthesia, but has little effect in block anesthesia. For many reasons, I prefer to use the minimum amount of vasoconstrictor.

Employment of an aseptic technic throughout the operation, skill and care in handling tissues, removal of fragmented bone, covering of exposed bone by flaps, and suturing and collapsing cavities in certain cases, keeping the socket free from saliva until the clot is organized and instructing the patient not to wash or disturb the wound or use effervescing mouth washes for a few hours materially help to prevent dry sockets.

When there is pyogenic granulation tissue at the cervical portion of approximating teeth, it should be removed at the time of extraction, as it may be a source of contamination.

Occasionally, we find a case in which, despite everything that we do to prevent it, this condition occurs. In this type of case, it is possible that there is a disturbance of endocrine gland function and a lack of calcium and phosphorus balance. There is room for research along this line.

The debilitating diseases—tuberculosis, pernicious anemia, diabetes, etc.,—can play a part, as we are dealing with a weakened host.

In the cases that do not furnish enough clot at the time of operation to protect the socket, it is well to dress the crypt from the onset, as it will save time for the operator and pain for the patient.

Let us visualize a case before treatment: The patient comes in from three to five days after the extraction, with pain, extreme pain in some instances, with a history that the socket was all right for the first forty-eight hours, then became sore and painful, gradually getting worse, the patient thinking the condition would abate. Examination reveals a socket with the content in a state of sepsis, or it may be open and fairly free from clot or débris. The patient complains of a foul taste and odor. Contiguous tissue is inflamed and very painful to the touch. We believe that the condition now present in the socket is one of sepsis produced by putrefaction and fermentation of dead organic matter, and, in this process, there are elaborated toxins and toxic products that are highly irritating to the tissues and are the cause of the pain.

Working on the foregoing conclusions, we apply therapeutic measures to correct the condition. We choose acetylsalicylic acid for its antiputrefactive and pain-relieving properties; balsam of Peru for its stimulating, antiseptic qualities; eugenol for its anodyne and antiseptic properties; sodium benzoate for its antifermentive action. Anhydrous wool fat (lanolin) is used as a vehicle. All of these ingredients are compatible and blend into a soft paste which is readily incorporated in gauze and easily adapted to the exposed bony walls of the cavity and exercises its different qualities in protecting the crypt from saliva and food débris.

In the treatment of this condition, we find that by irrigating the socket thoroughly, gently removing the contents, irrigating again and then gently dressing the exposed surfaces with 5 per cent iodoform gauze into which the paste has been incorporated in excess, we can dismiss patients for twenty-four hours, assuring

them of relief from pain, or at least considerable relief. When granulations appear, change is made to a more stimulating agent on the dressing, as the paste interferes somewhat with the granulating process. In the highly irritated cases, we find that by placing orthoform powder or procaine powder in the bottom of the socket at the first treatment, we are able to provide almost immediate relief from pain. In the severe cases, one of the barbituric acid group, morphine or codeine, is often indicated as the patient is sadly in need of sleep or rest.

The condition of sapremia, with toxic chill and high temperature, may accompany some of the neglected cases, but this subsides quickly as we remove the putrefying pabulum and treat the case.

With correct diagnosis, proper technic and care, many of these conditions may be avoided. Those that are not can be recognized and treated in the early stages, the patient and the dentist being saved unnecessary worry.

The formula for the paste follows:

℞

Acetylsalicylic acid	Grains 100
Balsam of Peru	Minims 50
Eugenol	Minims 10
Sodium benzoate	Grains 5

Anhydrous wool fat (lanolin) q.s. ad 1 ounce
Mix and fill collapsible tube.
Sig. Apply to socket on gauze.

We also find the paste efficacious in extensive infected areas where a dressing is indicated.

DISCUSSION

Henry B. Clark, St. Paul, Minn.: The changes in the peridental membrane in the alveolar bone, condensing osteitis, partial ankylosis and rarefying osteitis undoubtedly are factors in the condition generally known as dry socket. Probably the actual exciting causes of this condition are undue trauma of tissues, plus the presence in the socket, after the completion of the operation, of particles of infectious material, fragments of tooth substance and filling material such as cement and amalgam. When owing to bone changes, partial ankylosis, excementosis or the presence of abnormally shaped roots, it is anticipated or found at operation that undue resistance is to be encountered in delivering a tooth, the technic of operation should vary from that usually employed in the simple removal of a tooth or root. Instead of an attempt being made at once to deliver the tooth by application of forceps or lever, a flap should be formed and investing bone removed to such an extent that the tooth may be removed with a tipping movement and the minimum application of force. Certain uninformed people argue that formation of a generous mucoperiosteal flap and removal of investing bone to facilitate the extraction of a tooth constitute in themselves undue trauma or meddlesome surgery. This the well-informed and experienced operator will not admit, and it is not borne out by postoperative results. When such operations are done advisedly and skilfully, dry socket almost never occurs. Dr. Pell has suggested that, in the tedious, prolonged operation with frequent sponging, coagulum is formed in the ends of broken blood vessels. Coagulum is formed in the deeper parts of the socket and in the walls of the socket and, with frequent sponging, the infectious particles before mentioned, as well as other sources of contamination, are likely to be planted in this coagulum. The blood clot is an ideal culture medium for the growth of any bacteria which may be present. A method of handling this situation which seems more logical and likely to produce better postoperative results is described as follows: From the first incision, all blood and particles are removed by means of an aspirator. As the operation progresses, if it is long and tedious, the field is generously irrigated from time to time with physiologic sodium chlorid solution so that the blood is diluted and all infectious débris is carried away. As the operation is completed, the whole area is thoroughly irrigated, aspirated and carefully examined,

the operator making sure that no infectious particles or foreign material of any kind is left in the wound. The wound is then isolated until a fairly formed clot has filled it or some sort of a dressing is applied. The common experience seems to be that dressing such a wound immediately after operation is to invite difficulty. The suggestion that a minimum amount of epinephrine be used has been made. It is a good one, and it will bear repeating. In operating as above suggested, and using the aspirator, it is easy and convenient to proceed with little or no such material added to the anesthetic solution. The amount of epinephrine may be reduced to as little as 25 per cent of what we formerly thought essential. In the treatment of neglected cases, I quite agree with the outline Dr. Pell has given, except as regards the method of dressing the painful socket. Listing the therapeutic values of the agents in his prescription, we find that he expects pain relieving, antiputrefactive stimulating and antiseptic action. I believe that all of these values may be obtained in greater degree and more simply by using only one of the agents he mentions, eugenol. The use of a powder into which the eugenol is incorporated has advantages over use of an oily substance. The use of iodoform gauze is usually contraindicated in that it does not add enough beneficial action to compensate for its disagreeable features. As a final dressing, I prefer a paste made by spatulating together the liquid and powder of surgical cement. A thin mixture of this is used and into this a few fibers of absorbent cotton are incorporated, the offending socket being a little overfilled with the resulting mass. The liquid is essentially eugenol and the powder is a zinc preparation containing a little resin. The resin is dissolved and, after the dressing is in place in the presence of moisture, it hardens so that the mass becomes firm. The eugenol usually controls the pain very promptly and satisfactorily. The hardened mass prevents ingress of irritating material, while providing adequate drainage for all parts of the wound. In addition, the hard dressing acts as a splint against which the tender and irritated margins of the wound may rest, thus further minimizing the discomfort and contributing to a reduction of the inflammation present. Such a dressing has an added advantage in the fact that it can often remain comfortably in place for from three to five days or more. Such dressings are only changed if pain returns and are left off when there is no further pain and satisfactory granulations have formed. Healthy granulation tissue does form under this type of dressing more readily than any other type with which I am familiar.

Dr. Pell: This question, of course, is always treated individually and there are a good many remedies. It occurred to us about seven years ago that we must treat the septic condition in the socket. To me, it seemed nothing but sepsis, and to work out any sort of treatment against the prevailing condition there would aid. It probably would get well anyhow, but the patient is not comfortable and some of them are most uncomfortable. Dr. Clark prefers a paste that sets or is a little harder. I wish to see the patient every twenty-four hours until he is comfortable and then as the case demands, because some of the cases result a little disastrously if they are neglected. I do not like to put a hard dressing in, such as some that set, and leave them. I do not like the patient to be on his own hook, so to speak, and I do not like him to be neglectful, because when he comes back we have a worse condition to take care than would have been the case had we treated it regularly. The putrefactive by-products, hydrogen sulphide and ammonia and the putrefactive ptomaines, putrescin, neuridin and neurin, are highly poisonous, quickly disappearing compounds that occur in these septic sockets. The patient is sometimes poisoned severely, and the contiguous tissues are seriously affected.

THE NATIONAL MUSEUM OF DENTISTRY*

By JOHN T. HANKS, New York City

WHEN I presented a resolution to the House of Delegates at the Annual Session of the American Dental Association in Denver in 1930, requesting that a committee be appointed to investigate the possibility of founding a museum to be designated as a repository for historical data of the dental profession of the United States, I was not aware that many years before, in 1893 to be exact, the same resolution had been adopted, but, for several years, no activity of any kind along these lines had been apparent.

The dental section of the museum had been started. A committee of the A.D.A. functioned for a few years, and then the whole project was lost sight of, and, for a long time, no committee had been appointed.

A letter from the late Mark Finley, of Washington, gave information which led me to visit Washington and seek an interview with the Surgeon General of the Army.

A visit to the museum disclosed a dental section of considerable size, having a dental officer, Maj. James B. Mann, in charge. The collections are well arranged and cataloged. They consist of both anatomic specimens and historical instruments and appliances, housed in a room 18 by 52 feet. There are also many duplicate anatomic specimens available for study.

Accredited workers have the privilege of study and research and are assigned rooms and given every opportunity to pursue their work. In fact, the resources of the whole museum are at their command, as well as the Surgeon General's Library, housed in the same building and consisting of more than 500,000 volumes, together with numerous reprints, magazines, etc. There are thousands of slides, sections and gross specimens. The photographic department is complete.

The plans are prepared for a new building to be erected on the grounds of the Medical Center, where are also to be found Walter Reed Hospital, the Army Medical School and the Army Dental School and allied activities. In the plans for the new library and museum building, the space assigned for the dental section is 134 by 54 feet, or nearly eight times the size of the present quarters.

The museum at present has about 8,000 visitors a month. A more nearly complete dental exhibit would be interesting to about 100,000 visitors a year.

What we are specifically desiring to bring to the attention of your society at this time is the proposal that your body assume an active share in the plans of the Surgeon General through the formation of a "Registry of Dental and Oral Pathology" along the lines now laid down by the National Registry of Pathology under the auspices of the National Research Council.

A short résumé of this work being done by the registries, which has been

*Read at the Fifteenth Annual Meeting of the American Society of Oral Surgeons and Exodontists, Chicago, Ill., Aug. 5, 1933.

carried on for about ten years, may be enlightening.

The section on Ophthalmic Pathology of the Army Medical Museum was instituted in May, 1923, through arrangements made by the American Academy of Ophthalmology with the curator of the Army Medical Museum, with the approval of the Surgeon General of the Army. This collection has grown rapidly until it now comprises over 4,200 items, including case reports, drawings, photographs, lantern slides, models, historical documents, historical instruments, histologic sections and pathologic specimens pertaining to diseases and tumors of the eye. A considerable portion of the material for this collection was obtained from eye specimens sent in for diagnosis by ophthalmologists throughout the United States. All of this material is available for study by qualified and properly accredited persons and representative histologic sets on eye pathology are available for loan to members of the ophthalmologic society for study purposes. One of the activities of this section is the maintenance of the registry of eye tumors for the purpose of following up the course of each case from the time of registration to the time of death, when a necropsy protocol is obtained if possible. This follow-up system is facilitated by the use of blank forms mailed at regular intervals to the physician who contributed the specimens until the case is concluded. Information of great practical value with regard to the prognosis and treatment of melanotic tumors of the eye has already been published from this registry. A committee of consulting pathologists is appointed by the Academy of Ophthalmology for the study of the pathologic material forwarded to the museum collection. For convenience, one of the museum staff has been appointed on the diagnostic committee.

In 1925, the American Society of Pathologists and Bacteriologists arranged with the curator for the operation of a lymphatic tumor registry at the Army Medical Museum for the purpose of obtaining data for the classification, most suitable methods of treatment and prognosis of all types of tumors of the lymphatic system. This collection now includes 256 registered cases. As in the case of the eye tumor, the lymphatic tumor registry also has a diagnostic committee and a follow-up system for individual cases. When a sufficient number of cases have been registered, the results of the studies made will be published.

The American Urological Association started a registry for the study of tumors of the urinary bladder at the Army Medical Museum in 1927. Nearly 800 cases of bladder tumors have been sent to the registry by urologists throughout the United States. The operation of this registry is similar to that of the other registries.

By 1930, the registries operated at the museum had assumed such importance that it was deemed advisable to place them under the auspices of the National Research Council. Consequently, the activities of the registries were combined to form the National Registry of Pathology, under the supervision of a committee of nationally known pathologists appointed through the chairman of the division of medical sciences of the National Research Council. Although fostered by the National Registry of Pathology, the operation of an individual registry still remains within the province of the committee appointed by the parent association. The materials and records pertaining to each registry are filed at the Army Medical Museum, but remain the property of their own particular society. Whenever available, duplicates are filed in the permanent Army Medical Museum collection.

It is proposed that a registry of dental pathology be established to compare with those already functioning at the Army Medical Museum. There will be sections of this registry representing each participating constituent branch of the American Dental Association. This registry will be conducted by a specially chosen commissioned officer of the Dental Corps of the United States Army, who will be known as its registrar. He will be under the jurisdiction of the curator of the museum. A committee will be appointed by each such society to stimulate the use of this registry and act as consultants when called on by the registrar.

We ask that your society endorse this plan for the establishment of a registry of oral pathology and appoint such a committee.

The materials in the registry will be available, to a reasonable extent, for loan to contributors on approval of the registrar and consulting committee concerned. In all cases, contributors will be accredited for the material used.

Your society can secure such a quantity and variety of specimens, which may be arranged and housed to make a national center for the study of all phases of your specialty. There can be gross specimens in such number as to show the various modifications of the different lesions found in the oral cavity. Also sections, slides, photomicrographs and photographs can be prepared in endless numbers. Study rooms with every facility can be assigned to members of this society, who will be accorded all privileges of the museum and library to enable them to pursue investigation in their specialty.

The Surgeon General, the officers and curator of the museum and the members of the museum committee place themselves at your service.

DISCUSSION

Theodor Blum, New York City: This is an excellent idea and one which should be supported. Dr. Hanks may have created a wrong impression. You may think that the question of this department of dental pathology would mean that no school, society nor group of men in any other city except in Washington would have such a museum and such a registry. Of course, that would be absolutely wrong, an impossible situation, because not everybody can go to Washington: we must have local centers. We may have better men in other cities. If we have a tumor of a certain type, I am sure we will send it to Dr. Ewing in New York rather than to anybody else. But you will realize that this establishment of the registry in Washington is important because it can be made the one center where we could have the largest collection of material and where, for example, when I have duplicates, I could send one specimen, etc., to Washington, and I could ask Washington to let me have something which we have not in our registry. Now, one suggestion: As far as the classification or distribution is concerned, I did not see a group under dental pathology as you had it marked out. You had oral surgery, periodontia, orthodontia and prosthodontia. In what group would you, for instance, place pulp pathology?

Dr. Hanks: That would have to be worked out.

Dr. Blum: You would have to give that a little further thought. I hope that the whole group present here is in favor of the recommendation made by Dr. Hanks.

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Editorials

MEMBERSHIP: A SERVICE

Any organization brought together for the purposes of humanitarian service must grow. The extent of its service is the extent of human need. Health service must range wherever sickness and pain are found. An organization devoted to the relief of suffering can never, with self-respect, be satisfied short of having every honorable servant of health on its rolls. Its maximum of exercise for good ends there, and there only.

All grant that the need of dentistry justifies its purpose as much today as ever. Never before have the teeth as a source of trouble been understood as they are now. And that adds to the responsibility of dentists individually and collectively. Also, fewer men are studying dentistry today than before. Standing as it does the personification of dental intent and function, the organization is called on to perform along its entire front as never in the past. Medicine, the public, municipality and state necessarily turn to the A.D.A. for every service that concerns them. Where else can they go? And

this means that the Association needs every man of honest design in its ranks.

No one can say what the morrow will bring. Some men are full of foreboding. What will be its demand? No one can tell. Schemes foreign to the spirit of Americanism, foreign to the professional ideal are prophesied, and are imminently possible. How shall they be met? Not by an every-man-for-himself policy; not by isolated units of organization. Whether the A.D.A. can meet the situation for good or ill with assurance depends on its unanimity, its unity. Note then that its success calls on both the earnest and the indifferent within the organization and lays obligation on those without. Strength is needed to acquire the good as well as to oppose the bad. This is every man's issue, as loss will be every man's privation and gain every man's profit.

A professional organization gives to every man his opportunity to magnify his power, extend his influence, reach to far places, take part in great enterprises. Living in the greatest obscurity, a member of the A.D.A. may claim for himself, for his own hands and heart, a part in all its undertakings.

T.

THE DIET RACKET

For centuries, there was little said about diet. The ancients concerned themselves almost not at all about the kind of food they had; their chief problem was to get enough of it. And many of them even with a much smaller population than we now have practically starved for lack of sufficient food. When the problem of obtaining an adequate supply of food for the human race was more nearly solved, it soon became apparent that it really mattered what kind of food a man had. Then began that orgy of dieting that has nearly threatened us with disaster. It seems to be one of the propensities of human nature to go to extremes in any activity of our lives that has to do with our welfare.

The study of diet is a reasonable, a sensible and an altogether proper thing, but alas and alack, when our advertising dietitians got to going, they proceeded to ends that were neither reasonable nor

sensible. First, it was calories, and how they did play up that word calory! Every bit of food was measured in relation to its production of heat units, and the wonder is that with this theory riding high, poor suffering humanity was not frozen to death from sheer fright of the lack of calories in the food.

From this, we ran the gamut all down the line till we struck vitamins, and then we played that hard. Not that any one can say precisely what a vitamin is or analyze it so that the average individual can understand it, or use it in his physical economy. But it had a sonorous sound and it caught the imagination.

No one will argue that the thing called a calory or a vitamin is a myth, or that it is without significance. Much has been learned by our scientists about the effect of diet on the individual, but there was something that the scientists seemed to forget. They forgot that all individuals are not alike in their reactions to the various food materials, any more than they are to the action of certain drugs. A cut-and-dried diet is no more logical for all individuals than is a cut-and-dried remedy for every ailment. There is no such thing as an exact science in the administration of food or the administration of drugs. While the remark frequently quoted is hardly true that "what is one man's food is another man's poison," the fact remains that no two individuals react in precisely the same way either to food or to drugs.

This does not mean that there are not certain fundamental effects in diet that must be recognized. If a man persists in eating half a dozen eggs for his breakfast every morning, it is not difficult to predict what will happen to that man. But even here we are not always so sure of our ground. The demonstration of Clara Davis in her experiment on the self-selected diet for children, published in THE JOURNAL, June, 1927, June, 1931, and April, 1934, was a revelation worth considering. It put to shame many of the ironclad rules that had been sagely formulated in connection with diet especially for children, and pointed the way to greater sanity in the selection of individual diets. The lesson it taught, and the lesson we all need to learn is that if we have any sense of individual acumen or responsibility, we shall each map out for himself, as soon as we reach the age of accountability or even earlier, the kind of regimen that is best

suited to our individual needs, and follow this to the exclusion of all the various dietary fads that are foisted on us by the propaganda of commercial interests. It will usually be found that the more sensible we become in our diet, the simpler will be the diet. If we have any intelligence, we shall soon learn the kind of food that best suits our individual needs, and usually it will be found that the foods most adaptable to our requirements are those close to nature and not complicated with too much cost. If fruit and a carbohydrate best fit your requirement for breakfast, why not use a simple raw or native fruit and bread and milk rather than tickle the appetite with expensive jam and the costly prepared breakfast foods?

The exploitation of some of our prepared foods has degenerated into a regular racket, and it is costing the consumer a vast amount of money and serving a much less beneficial purpose in the human economy than the simpler and more nearly native foods. Usually, the man who is the highest liver is the shortest liver. Nature has a way of rebelling against too much concentration or too much artificiality in our food, and we shall do well to cultivate the simple life. Above all things, we should each study his individual needs, and adapt ourselves to the regimen that has been proved by experience and observation to be the one best suited for the individual case.

A little intelligence and a little study will teach us more about our own requirements than all of the theorizing of the scientists and the dietitians.

ACCEPTED DENTAL REMEDIES

Beginning with the October, 1933, issue of THE JOURNAL, the Council on Dental Therapeutics has been publishing monthly the material known as Accepted Dental Remedies, with which all of our readers must by this time be familiar.

The series is now completed, and in consonance with the plan outlined in the beginning, the material is to be gathered in book form and made conveniently available for the profession. After an infinite amount of labor on the part of the members of the Council, and especially of the chairman and secretary, this long looked for

volume will shortly be issued at a very nominal cost, not more than $1, and thus another achievement of the Council will be made manifest.

This book has been called for by the profession for some time, and now that the plan is to be consummated it calls for congratulations on the part of all concerned. At the recent meeting of the Council, April 20-21, 1934, there was considerable enthusiasm over this volume on the part of the members, and when men of the caliber of the Council unite in a common and kindred purpose with the unanimity expressed at this meeting, it augurs well for the success of the undertaking.

The publication of this book is merely one more achievement emanating from the American Dental Association in furtherance of an effort to serve the profession in a concrete and constructive way. It may be accepted as one of the important functions of organized dentistry to dispense service of this character for the welfare of the profession at large, for be it known that when a book of this character is released for distribution, its benefits accrue not only to the personnel of the membership itself, but also to every dentist or physician who wishes to avail himself of the privileges of possessing a copy.

Essentially, then, there is an actual utilitarian aspect to this enterprise that must not be ignored; in fact, the service of the whole Council in administering its affairs savors of this kind of unselfish service. The men who act on the Council do so gratuitously, and while this fact has repeatedly been noted, it will do no harm to have it stressed on all occasions. Some of the men are obliged to travel great distances to attend the meetings and at considerable inconvenience to themselves, to say nothing of the amount of time spent in carrying on the routine service of the Council between meetings; and it may also be said that they are men of rare intellectual acumen whose services could never be secured merely on the basis of financial remuneration.

The entire Association is under the deepest obligation to the members of the Council for an unselfish service that is unique in human affairs, and when the sum total of the results has been enumerated, it will be found that the rewards that come to the men most

instrumental in carrying on the work consist for the most part merely in the consciousness of having done something for the Association, and contributed an appreciable quota to the welfare of human kind.

Look for the book Accepted Dental Remedies, and secure a copy as soon as the volume is issued.

A POINTED CRITICISM OF THE CONTENTS OF OUR JOURNALS

Some time ago, we received the following anonymous communication, and while the usual route of an anonymous letter is straightway in the direction of the waste paper basket, somehow this one, on account of its character, has lingered on the editorial desk for months. Here it is:

Dear Editor Journal:

As I have said before, a dentist might read his head off in all the dental Journals of all kinds, and he would be more mixed up and confused than if he stuck to the education he received in dental college, and his own experience.

In view of some of the reflections on our dental schools, here was an unexpected tribute to the value of the training that is given by our faculties. Coming unsolicited as it did, it constituted a rather spontaneous endorsement of our colleges, while at the same time it implied a somewhat severe arraignment of our journals.

It must be rather heartening to our teachers to think that the instruction they are imparting to the students in college is sufficiently effective that it serves to guide the practitioner, according to this observer, in his future career as a dentist.

On the other hand, the question is raised: Are our dental periodicals turning out the most constructive material for the welfare of the profession?

Let us see. To avoid making invidious comparisons between the efficacy of college training and the reading of our literature, it is merely necessary to point out the patent fact that there can be no possible conflict between the two for the very simple reason that the one supplements the other instead of the one opposing or dominat-

ing the other. The function of each is different. True it is that there is often—too often—conflict of opinion in the printed page between men as to matters of policy or even as to statements of so-called scientific fact as expressed in our literature. No two men may be expected to agree perfectly in any written presentation, and there is assuredly considerable confusion of ideas among the producers of our periodical literature; but is there always unanimity of opinion among the teachers in our professional schools? Do they invariably preach according to the law and the gospel? Nay, verily, my brethren, the men in high places in our college halls on occasion promulgate doctrine that will not stand the acid test of time and experience. Is there not the necessity for constant revision in our teaching? Can we name one single line of reasoning in the lecture room or clinic that is infallible? The thing that we honestly proclaim as fact today is often figuratively shot full of holes tomorrow. Nothing is final.

Why then must our critic so pointedly reflect on the findings of the printed page, and place so much reliance on what was told him when he was a student in college? The crux of the whole matter is this: For everything taught in college and for every idea advocated in print, there must be an evaluation on the part of the listener or reader before he can accept without reserve the theories that are proffered him. To swallow unreservedly the offerings of any man, whether he be a professor in college or a contributor to our journals, is not to stand four square to the world and exercise the independence of thought that is the inherent right of any thinking man.

We do believe that in one respect our anonymous correspondent has a basis of justification for his reasoning. When he intimates that the teaching in college is more reliable than are the ideas of a contributor to a journal, he is probably right to this extent, that the theories taught in college are more generally carefully formulated and better thought out than are the arguments advanced by the average writer. In the very nature of things, a lecturer to a class of students is inclined to be more careful of his statements and to make himself more certain of the authenticity of his advice than is a writer for an audience of practitioners. This may appear a strange statement to one who has not had unlimited opportunity to work with students, or to appraise periodical literature, but of one thing there is a cer-

tainty: that for keen observation and a penetrating insight into essential values, a class of students may be depended on more surely than a similar number of practitioners. The truth of this statement has been repeatedly attested, and thus with the single exception of the research essays in our journals, the average paper carries with it less authority than the teaching in college.

Little wonder, then, that our critic complains of the confusion in our periodical literature; yet it may be pertinent to raise the question as to what could happen without our journals. Are they not, after all, the very life blood of professional progress? With all their limitations, do they not serve an important purpose and fill a need that cannot be met through any other medium? Nothing is perfect in human affairs and it behooves us all to be charitable.

If it may be admitted that our journals fall short of presenting the mental pabulum best suited to our needs, is it not true that they merely mirror the mentality of the profession? Can the stream rise higher than its source, and shall we expect perfection where there is no perfection?

We need our dental schools, and we need our journals. Let us be thankful that they are not more imperfect than they are.

VISUAL EDUCATION

It is late to discuss the motion picture as a teaching medium if its first use in medicine is considered, although early if one is to consider its use in dentistry. In 1918, R. Tunstall Taylor experimented with it as an educative agent and made a report in the *American Journal of Orthopedic Surgery,* November, 1918. Selecting three groups of students, he instructed one by means of lectures and lantern slides; with another, he used motion pictures and lectures, and, with the third, he used only the lectures. A given subject was presented by one lecturer. The results were higher average grades among the lecture-motion picture group. Hospitals have used the cinema for years to teach obstetrics, pediatrics and surface and motor symptomatology.

In the basic sciences, the development of fertilized ova taken from microscope and oven has been shown, the mitotic phases that

required hours for their actual maturation being seen in a few seconds. Bacteria and parasites have been the subject of demonstration. Peristalsis, heart action and joint movements have been reproduced on the screen. Surgical technic is made visible with perfect accuracy for a room full of observers. In this respect, its advantages are second only to having a place at the operating table.

The motion picture has many advantages. It speeds up the curriculum. It intensifies training, with reduced effort on the part of the student. It preserves atypical cases that a student might otherwise miss throughout his entire course. The films are light and easily portable; they can be stopped and elucidated as a lantern slide, and "close ups" or "slow motions" may be presented at will.

Furthermore, the films can be used advantageously for reviews, with results in time saving and didactic effort far surpassing any other method. And in all probability, in mnemonic value, also they supersede any other means of teaching.

That difficulties are encountered is obvious. The cost is first in this as in any other new departure. Then too, a trained manipulator of the apparatus must be obtained. The adaptation of the light to the operation and the operator is not easy in many instances. Teachers must of necessity choose the phases of their programs that are most adaptable. All in all, the addition of cinematic effects to the teaching technic of any school must needs be slow. Once installed, the value of it is manifest.

Recently, a motion picture demonstration was given of removal of mandibular third molars. The process was that developed by the greatest exponent of the ossisector method. So thoroughly has this master perfected his procedure that the tooth's removal was almost mechanistic. There was no lost motion in the technic, no misapplication of instrument, no failure. Supporting lines appeared, instructive lines, expository lines, causes of failure, and the failure in panorama. Ossisectors with razor edges sliced and shaved cortical bone as if it were chalk. Not a tooth broke. The operation required only a few seconds.

Observers invited to criticize remained to wonder and praise. On one who has extracted always with a modicum of hesitation and fear, a composure settled that was delightful. The delusive easiness

of it! The teeth came out as if trained. The levers were wands that indicated their master's will. The experience was good for the man who needed courage and faith for bolder effort. But the composure did not last long. Of a sudden came the realization that theoretically nothing was being learned. Of a truth, teeth must follow their curvatures, bony interference must be eliminated, etc. The major element in this display was the personal equation. Back of every move was a man who had spent a quarter century in tireless study, study wherever skulls were found, study of bone, study of mechanics and endless experimentation.

What of the effect of this visualization on the youth without experience in extracting? Would the ease of it affect him as it did an older or a more experienced man? The artificial mandible yielded to the knife as if it were chalk. These ossisectors were irresistible. The worst impaction was a straw in the wind before them. When the youth essays the job, he will find that jaws are bone, that teeth confound rather than oblige, that instruments are so much scrap-iron without—something else—that personal element. Such was the finesse of the cinematic operation, the thought came: Could Homer ever teach Achilles to write an Iliad? And yet the effect was a deep sense of betterment and personal gain.

Educators who have made especial study of the motion picture are slow to give it great praise. They concede its place and its worth, but would not supplant the prevailing methods of teaching. It tempts to speed, and speed leads to superficiality. It tends to shorten courses rather than to deepen them, not because of the picture itself, but because of an unfounded confidence it inspires. Speed for sales or mileage or unit production is commendable and practical, but for mental expansion and extension, it is profoundly debatable. Dental education like medical education must still be a process of outline, formula, teacher and textbook and laboratory. It might be greatly feared that if a motion picture should shorten courses, the time saved would be filled in with other subjects. And that would be calamitous. As conditions are now, the student must wait until graduation for the integration and correlation of what he has memorized, and for this, he pays in disappointment and inefficiency.

T.

THE ST. PAUL MEETING

There are various agencies through which a meeting may be made a success: the season of the year, the character of the meeting place, the facilities for transportation, the attractiveness of the entertainment, the significance of the issues that are at stake at the particular time in the profession—all of these tend to attract members and create interest. But the one outstanding thing that is most essential is the nature of the program. That, after all, is the magnet that draws the members together and holds them at the sessions in a community of sentiment and absorption that spells success in the surest sense.

This year, everything seems propitious for a most unusual meeting. The Local Committee on Arrangements are providing facilities for the convenience and comfort of the visitors, the natural habitat of the meeting place is such as to attract those who are intending to make a vacation of the event, either before or after the meeting, it is settled that the traffic association will grant a round trip for a fare and a half, in addition to which the surcharge has been taken off for sleeping cars, thus the cost has been materially reduced. Lastly, the program promises to be one of the most interesting and attractive that we have had in years.

The general sessions, arranged by our own officials, are to be entertained by men of note in the nation, such as the Hon. Henrik Shipstead, United States Senator, and Dr. Elmer V. McCollum, dietitian, of Baltimore. The former will talk on "Legislative Phases of our National Administration," and the latter on "Dental Caries in Relation to Diet and Nutrition."

It should be stated that the St. Paul Auditorium, where the sessions are to be held, has high ceilings, with air conditioning throughout, assuring the utmost comfort to those in attendance. An excellent amplifying system has been made available, to the end that the speakers may function without difficulty, and to the perfect satisfaction of the audience.

The various sections are to be properly housed, with permanent walls between them, a feature which will contribute immeasurably to the effectiveness of the Section work. The Section officers

are organizing a program that will portray every activity of dental thought, both from the theoretical and from the applied aspects.

Of particular interest will be the clinical program, embracing as it does at this time more than three hundred clinics, demonstrating every phase of practical dentistry.

There is no question that clinics make a strong appeal to the large majority of our members. To actually see how a process is performed means more than any amount of written description, and every member attending the meeting will have ample opportunity to see demonstrated any and all processes that may interest him.

The American Dental Association is the great clearing house of the whole profession, and the annual meetings are the mileposts on the way to real dental progress. Come to St. Paul in August and help to register one more step toward the consummation of all that is latest and best in the practice of dentistry.

THE NEED OF THE HOUR

The greatest need of the hour in dentistry is not so much the consummation of a better technic—better fillings, inlays, crowns, bridges or dentures. The fundamental need is to save the soul of dentistry, to preserve the ideals and the ethics of our profession, to stand four square to the world in the establishment of those principles that gave us professional status at the beginning, to prove the faith that is in us for the maintenance of a high ethical concept that shall create a sharp distinction between our policies as a profession and the practices of the market place.

The worship of mammon has no part in the scheme of real professional life. The exaltation of an ethical faith, the consecration of our energies to the service of poor and rich alike, the sacrifice of our comfort for the welfare of others—these things are the need of the hour in our profession. All else will be added unto us if we but stand fast, and proclaim our conviction before the world.

FRANK O. HETRICK, D.D.S.

As we go to press, word is received of the death of Frank O. Hetrick, Ottawa, Kan., Past President of the American Dental Association. A more extended notice will appear in the July issue.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Notification Cards—To safeguard the welfare of the average patient, it is necessary for the practitioner to notify the patient to appear at the office for examination of the teeth at regular intervals. This, of course, must always be done with the full understanding of the patient. In fact, the approach should be made in such a manner that the request for notification comes from the patient instead of from the practitioner. With this understanding in advance, a suitable card may be printed and mailed as follows:

Dear_____

In accordance with your request of (date of last visit) I am hereby notifying you that the time has arrived when your teeth should be examined. Time speeds, so does a decaying cavity in a tooth. This notification is sent to prevent you from having any large or painful cavities. An appointment for examination is hereby enclosed. If the date is not convenient, please telephone for another.

Sincerely yours,

_____

A card such as this if agreed on in advance will absolve the practitioner of any charge of proselyting, and will protect the patient against oversight or too long neglect.—*J.P.H.*

Cavity Preparation for Inlays—Inlay cavity preparation is suggestive of stones, with which all cavity forming procedure might be advanced. Burs have blades which are not quite so smooth running as true stones. Grinding with a wet stone is preferable to cutting with dry steel because friction often makes "cold steel" warm or even hot. Wet stones are cooler and quicker too.—*Herbert Ely Williams, Red Bank, N. J.*

Protecting Gas Tubes—Every vulcanizer that has a gas regulator on it should have the gas supply rubber tube cut and a glass pipe such as comes with an anesthetic in it placed in the rubber tubing with a small loose pledget of cotton in it. Flakes of rust in the pipes, especially in old buildings, will be carried down the pipes and the cotton will prevent these flakes from getting under the diaphragm in the gas regulator, which would spoil an otherwise good case, putting the regulator out of commission. This is a cheap and positive preventive.—*George H. Henderson, Chicago, Ill.*

Taming the Patient—As the bridle tames the colt, so the rubber dam tames the patient. Once the dam is placed, the patient seems to become another person entirely. It eliminates 90 per cent of his uneasiness and 100 per cent of his talkativeness. It keeps the tooth dry and reveals more defects than were supposed to be present. Dam weights are too light. After the rubber dam is in place, both ends of the towel holding chain to the dam are tucked under the rubber dam holder to make the patient more comfortable. The patient is instructed to catch two fingers in the loop of the chain and pull down sufficiently to compress the lower lip. The patient seems to enjoy his contribution to the undertaking and automatically opens his mouth wider, as he pulls down more.—*Herbert Ely Williams, Red Bank, N. J.*

Collect Your Accounts—Pay Your Bills—One of the really practical points in dental economics lies in the simple aphorism to collect accounts and pay bills. As the dentist cannot well pay his bills unless he collects accounts, he should first concentrate on making collections. He can do this without offending people, if they are at all reasonable. If they are not reasonable, he can make them so by the sincerity of his approach. When he has made collections, he should pay his bills at once. This is fully as important as collecting accounts. These are the requisites for success.—*Economist.*

Viewing Both Ends of a Lower Third Molar—The case is of a horizontally, or semihorizontally impacted lower third molar. The object is to get a good roentgenographic view of the tooth. The routine technic for the lower third molar region calls for the placing of the film packet with the mesial edge at the middle or distal aspect of the second bicuspid and the horizontal roentgen-ray angle directed straight through the second molar, which is to say distolingually. This position of the film and horizontal angle often fails to include the ends of the roots of a horizontally impacted third molar on the film. Correction of this fault may be accomplished in one of three ways: 1. By placing the film packet farther back. 2. By resorting to extra-oral placement of the film. 3. By modifying the horizontal roentgen-ray angle. It is not always possible to force the film packet back far enough to correct the fault by this means alone. Extra-oral placement of the film has many drawbacks, especially for the general practitioner. By placing the film packet as far back as possible, and also changing the horizontal angle either to straight lingually or somewhat mesiolingually, the operator can practically always include the periapical region of the third molar on the intra-oral film. This change in horizontal angle will usually cause overlapping of the images of the crowns of the second and third molars, if the third molar sits a little toward the buccal aspect as it usually does. But the routine angle will have obtained a good view of the coronal two-thirds of the tooth, and this second negative will afford a view of the apical and periapical region. Thus, the two negatives together assure a good view of both ends, coronal and apical. If the operator uses Raper film-holders, the use of holder No. 2 will enable him to get the film packet farther distally, with less discomfort to the patient, than will the use of No. 1, usually used in this region.—*Howard R. Raper, Albuquerque, N. M.*

COUNCIL ON DENTAL THERAPEUTICS

ACCEPTED DENTAL REMEDIES

The following articles have been accepted as conforming to the rules of the Council on Dental Therapeutics of the American Dental Association for inclusion in the list of Accepted Dental Remedies. The Council desires dentists to understand that the admission of an article does not imply a recommendation. A copy of the rules which govern the Council in the consideration of articles will be sent on request.

SAMUEL M. GORDON, *Secretary.*

ANESTHETICS — LOCAL[1]

PROCAINE HYDROCHLORIDE TABLETS, 0.2 Gm. (3 grains).—A dosage form of Procaine-Abbott, A.D.R.

Actions and Uses: (See Accepted Dental Remedies [J.A.D.A., 20:1899 (Oct.) 1933.])

Manufactured by Abbott Laboratories, North Chicago, Ill.

COMPOUNDS CONTAINING TRIVALENT ARSENIC[2]

ARSPHENAMINE, D.R.L.—A brand of arsphenamine, U.S.P.

Actions and Uses: (See Accepted Dental Remedies [J.A.D.A., 20:1901 (Oct.) 1933.])

Manufactured by the Dermatological Research Laboratories, Philadelphia, Pa., a division of the Abbott Laboratories, North Chicago, Ill.

Arsphenamine, D.R.L., 0.1 gm. ampoules.
Arsphenamine, D.R.L., 0.2 gm. ampoules.
Arsphenamine, D.R.L., 0.3 gm. ampoules.
Arsphenamine, D.R.L., 0.4 gm. ampoules.
Arsphenamine, D.R.L., 0.5 gm. ampoules.
Arsphenamine, D.R.L., 0.6 gm. ampoules.
Arsphenamine, D.R.L., 1.0 gm. ampoules.
Arsphenamine, D.R.L., 1.2 gm. ampoules.
Arsphenamine, D.R.L., 1.3 gm. ampoules.

NEOARSPHENAMINE, D.R.L.—A brand of neoarsphenamine, U.S.P.

Actions and Uses: (See Accepted Dental Remedies [J.A.D.A., 20:1902 (Oct.) 1933.])

Manufactured by the Dermatological Research Laboratories, Philadelphia, Pa., a division of the Abbott Laboratories, North Chicago, Ill.

Neoarsphenamine, D.R.L., 0.15 gm. ampoules.
Neoarsphenamine, D.R.L., 0.3 gm. ampoules.
Neoarsphenamine, D.R.L., 0.45 gm. ampoules.
Neoarsphenamine, D.R.L., 0.6 gm. ampoules.
Neoarsphenamine, D.R.L., 0.75 gm. ampoules.
Neoarsphenamine, D.R.L., 0.9 gm. ampoules.
Neoarsphenamine, D.R.L., 1.5 gm. ampoules.
Neoarsphenamine, D.R.L., 3.0 gm. ampoules.
Neoarsphenamine, D.R.L., 4.5 gm. ampoules.

BARBITALS[3]

BARBITAL-ABBOTT.—A brand of barbital, U.S.P.

Actions and Uses: (See Accepted Dental Remedies [J.A.D.A., 20:1904 (Oct.) 1933.])

Manufactured by Abbott Laboratories, North Chicago, Ill.

Barbital-Abbott, 5 grain tablets.

1. Anesthetics-Local, J.A.D.A., 20:1895 (Oct.) 1933.
2. Compounds Containing Trivalent Arsenic, J.A.D.A., 20:1901 (Oct.) 1933.
3. Barbitals, J.A.D.A., 20:1904 (Oct.) 1933.

BARBITAL-SODIUM, ABBOTT.—A brand of soluble barbital, U.S.P.
Actions and Uses: (See Accepted Dental Remedies [J.A.D.A., 20:1906 (Oct.) 1933.])
Manufactured by Abbott Laboratories, North Chicago, Ill.
Barbital-Sodium, Abbott, 5 grain tablets.

PHENOBARBITAL-ABBOTT.—A brand of phenobarbital, U.S.P.
Actions and Uses: (See Accepted Dental Remedies [J.A.D.A., 20:1906 (Oct.) 1933.])
Manufactured by Abbott Laboratories, North Chicago, Ill.
Phenobarbital-Abbott, one-quarter grain tablets.
Phenobarbital-Abbott, one-half grain tablets.
Phenobarbital-Abbott, one and one-half grain tablets.

Chloramine Preparations[4]

DICHLORAMINE-ABBOTT.—A brand of dichloramine, U.S.P.
Actions and Uses: (See Accepted Dental Remedies [J.A.D.A., 20:2258 (Dec.) 1933.])
Manufactured by Abbott Laboratories, North Chicago, Ill.
Dichloramine-Abbott, 4.6 grain tablets.

Chlorinated Paraffin[5]

CHLORCOSANE, ABBOTT.—A brand of chlorinated paraffin, U.S.P.
Actions and Uses: (See Accepted Dental Remedies [J.A.D.A., 20:2075 (Nov.) 1933.])
Manufactured by Abbott Laboratories, North Chicago, Ill.

Caffeine Sodio-Benzoate[6]

CAFFEINE SODIO-BENZOATE-ABBOTT.—A brand of caffeine sodio-benzoate, U.S.P.
Actions and Uses: (See Accepted Dental Remedies [J.A.D.A., 20:1909 (Oct.) 1933.])
Manufactured by Abbott Laboratories, North Chicago, Ill.
Caffeine Sodio-Benzoate Ampoules, seven and one-half grains—Abbott.

Emetine Hydrochloride[7]

EMETINE HYDROCHLORIDE-ABBOTT.—A brand of emetine hydrochloride, U.S.P.
Actions and Uses: (See Accepted Dental Remedies [J.A.D.A., 20:2087 (Nov.) 1933.])
Manufactured by Abbott Laboratories, North Chicago, Ill.
Emetine Hydrochloride, 1 grain ampoules.

4. Chloramine Preparations, J.A.D.A., 20:2258 (Dec.) 1933.
5. Chlorinated Paraffin, J.A.D.A., 20:2075 (Nov.) 1933.
6. Caffeine Sodio-Benzoate, J.A.D.A., 20:1909 (Oct.) 1933.
7. Emetine Hydrochloride, J.A.D.A., 20:2087 (Nov.) 1933.

To the keen observer of matters medical it must be evident that the physician who has secured a firm grasp on the possibilities and the limitations of medicinal substances, as indicated by their pharmocodynamic action, will not be misled either by the wily tales of the detail man or the all too frequently haphazard clinical observations made by overzealous fellow practitioners. A physician who has mastered the fundamentals of pharmacology will thoroughly appreciate that there can be no virtue in secrecy so far as drugs and medicinal substances are concerned, and will readily recognize the self-evident fact that all of the effects produced by esoteric combinations of well-known medicaments can, and must, be produced equally well by the use of the same medicaments under their proper designations.—Hatcher and Wilbert in "The Pharmacopeia and the Physician."

Dr. Sidney Sorrin
269 West 72nd Street
New York City
Telephone Trafalgar 9517

May 3, 1934

Dr. Samuel M. Gordon,
Journal of American Dental Association,
212 East Superior Street,
Chicago, Illinois.

Dear Dr. Gordon:

I was astounded to learn from your review in the May issue of THE JOURNAL of the A.D.A. that my name and opinion were used by the manufacturer of a commercial preparation. Neither have I ever been approached by that corporation for any endorsement whatsoever, nor have I ever authorized the use of my name or opinion for their product.

Please accept my thanks for your vigorous and intelligent exposure of the distortion of my views. They concerned themselves solely with suggestions to the operator after he had completed the grinding procedure of natural teeth. Your comment that "grinding of the teeth or the application of any abrasive to them must be made under the immediate supervision and control of the dental operator," correctly covers the situation.

Please find enclosed a copy of a letter which has already been sent to the manufacturer in connection with their unwarranted use of my name and opinion.

You have my permission to publish this letter in THE JOURNAL if you so desire.

Very sincerely yours,

(Signed) Sidney Sorrin.

May 3, 1934

Beacon Scientific Co.,
32 Union Square,
New York City.

Dear Gentlemen:

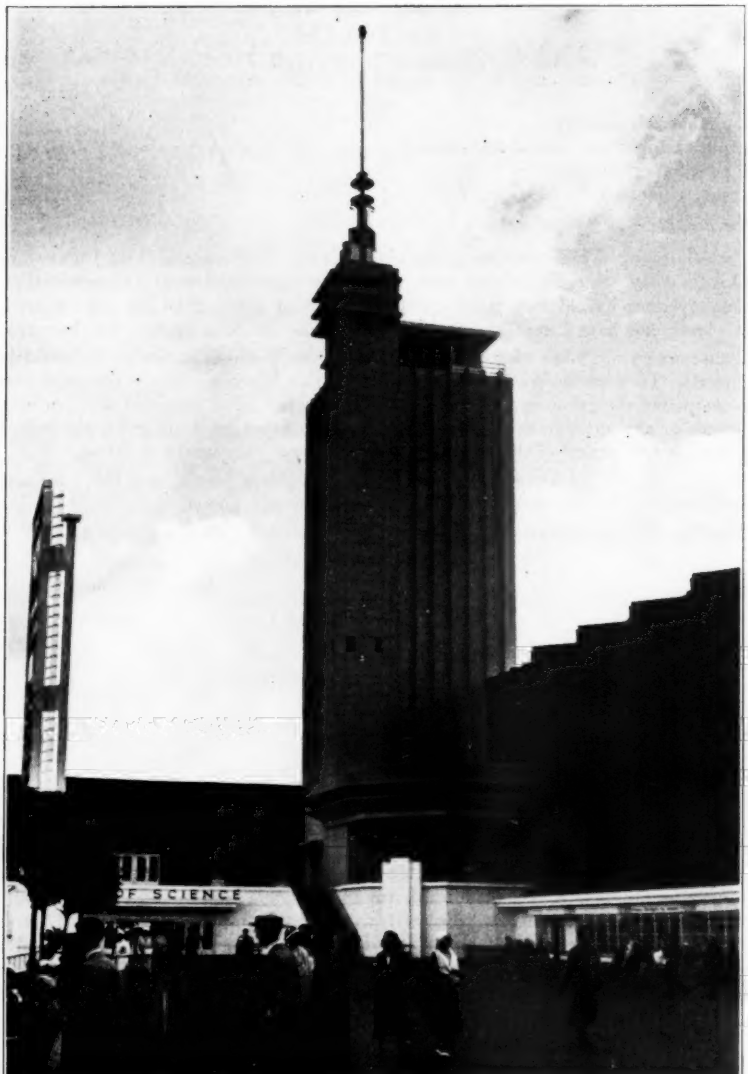
There has been directed to my attention through the article on page 899 of the May 1934 issue of THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION, the fact that you have mentioned my name and have printed an alleged citation from a paper written by me in connection with a preparation you are advertising.

This is a brazen audacity on your part, particularly since you not only had absolutely no authority to quote me, but also since you have distorted a portion of my published article to serve your own purposes.

I require an unqualified apology and retraction from you, and I shall be guided in further proceedings on my part, by your reply and explanation.

Very sincerely yours,

SS/AJM



Hall of Science, Home of the Dental Exhibit of Chicago World's Fair, 1934. (Photograph by Dorothy Lee.)

BUREAU OF PUBLIC RELATIONS

A SURVEY OF THE RESPONSE BY THE MEDICAL AND DENTAL PROFESSIONS FURNISHING CARE UNDER FERA CIRCULAR NO. 7*

By HERBERT E. PHILLIPS,† D.D.S., Chicago, Ill.

THE publication of Federal Emergency Relief Administration Circular No. 7 laid the foundation for a profound reorganization and shifting in the entire method of payment for medical treatment for those Americans receiving various forms of relief. By the provisions of this circular, the medical and dental societies were asked to enter into a contract with the government whereby their members would render health service to the indigent upon a fixed fee basis. With few exceptions, this is a new function and experience for both organizations, calling for adaptation to a situation never previously existing on a national scale.

The professions were not without mental preparation for such adaptation. Even before the immediate problems of the depression, urbanization and the complications of modern industrial society were tending to make the traditional professional position of giving free care to the indigent too heavy a load for the professions to carry. The number 1 minority report of the Committee on the Costs of Medical Care, later endorsed by many medical groups, stated (as did the majority report) that payment for medical care of the indigent was a community responsibility. Changes then in progress justified those who wrote the report, and it assisted the professions in making some mental adjustments. Nevertheless, it is improbable that either its authors or their endorsers had any inkling of its far-reaching effect. They could not foresee that the principle which it announced would be embodied by the national government in a program of state medicine, for upwards of 15,000,000 unemployed—as many or more than are included in the British Compulsory Health Insurance scheme.

If unemployment relief continues for a long period of time, this pattern of routing health service will be woven into the warp and woof of professional and governmental experience. Many authorities believe that the same pattern of medical care may be called on to serve low income groups in the future. Because of the present need of good service and the possible use of this system in the future, it is important that professional and administrative groups come to an early understanding. Because the technic of organization and the attitudes of the groups involved are of primary importance in the successful operation of the service, this survey has been attempted.

*Statistical data by Miriam Simons Leuck.

†Former chairman of the Committee on the Study of Dental Practice.

CONTENTS OF FERA CIRCULAR NO. 7

In its introduction, the circular provides for the maintenance of the traditional physician-patient and dentist-patient relationship. Supervision of the circular's provisions is entrusted to state and county administrators, whose duties it shall be to inform and consult the related professional societies, to formulate in cooperation with these societies a program of service and a fee scale, such authorized service to "be a minimum consistent with good professional judgment" and "shall be charged for at an agreed rate which makes due allowance for the conservation of relief funds." Service may be rendered in home or office, but shall not supplant existing clinics and similar institutions. The duties of the administrative officer shall also include provision for the written authorization for service for relief clients, and for reinvestigation of the patient in the home in case an extension of service beyond the two-weeks limitation is desired. The final authority and responsibility for approving the various local programs rests with the State Emergency Relief Administration, which is advised to secure the assistance of committees from the various professions.

The professional obligations under the act consist of cooperation on invitation with the administration in formulating a program and a fee schedule, both state and local, and the application of professional judgment in setting medical standards and, once an agreement has been reached, of fulfilling its terms. Taking into consideration the stress under which the circular was prepared, it has served well as a foundation on which administration and professions could meet and make adjustments under its terms. As will be later apparent in this report, there are certain points at which, in the circular, jurisdictional limitations are not carefully drawn, and what services are included under the terms of the circular is not clearly defined.

Although these few vague spots have given rise to the larger part of the complications and friction observed to date, the circular on the whole gives full recognition to the professional traditions of free choice, patient interest and personal relation. The assistance of a representative of the American Medical Association in drafting the circular, as well as the professional understanding of Mr. Hopkins, explains the attitude expressed on this subject. The lack of consultation with American Dental Association officers may explain the ambiguities of language which have puzzled dentists attempting an intelligent interpretation of the provisions relating to dental care.

REACTIONS TO THE CIRCULAR

Professional allegiance, local customs and psychology, the financial situation and even personalities all worked to produce a varied series of reactions to the circular. The professions involved were not united within themselves. Among physicians and dentists, some recognized and some feared that the application of the circular might result in an immediate involvement in state medicine. Others welcomed it as a partial solution of a problem weighing heavily on both patients and professions. Frequently, the relief administrator in a locality and his staff of social workers appeared to be on one side, while the health professions seemed ranged to oppose him. Sometimes, all elements worked in cooperation; at others, none of them appeared interested.

The situation was further complicated by the fact that, as the Federal Emergency Relief Administration was organized by states, the state professional societies appeared to be the logical units for cooperation with the administration in preparing agreements. Yet the action of

these state societies is not binding on the several local groups composing their membership. State fee schedules and programs of work are merely advisory. As a result, the state societies have sometimes accepted a scale which the local societies considered too low, and it was thereupon repudiated. In some cases, the state has refused all cooperation, while the local societies entered into agreements. Both courses produced confusion and hard words.

To the professions, the most fundamental of the psychologic problems raised by such a service as that contemplated under FERA 7 was a fear of "state medicine." This fear persists in spite of the medical society endorsements of the minority report of the Committee on the Costs of Medical Care, with its recommendations for community responsibility for payment for services to the indigent. In many areas, it was modified by a realization that the old method of free care for the indigent by these professions had collapsed to a greater extent than ever before. Men who had always done a certain amount of charity work, who had, in accordance with the old tradition, carried patients through temporary financial distress, found in 1932 and 1933 that the few remaining patients who could or would pay were not enough to support the costs of maintaining a practice. Such men were willing to experiment with a new method of payment, once assured of safeguards to their professional standards.

The administrators of the act sometimes displayed another form of psychologic opposition. Many of them were drawn from the ranks of social service workers, to whom the rendering of medical service appeared but another branch of the great task of relieving the ills entailed by poverty. Such workers are members of a relatively new profession which deals with individual clients affected by social maladjustment or pathologic conditions. Their professional duties to their clients in securing either free or low cost needed health service have often made it appear that they were encroaching on the old-established areas occupied by the health professions. As a result, among the less analytic members of these health professions, there is often a feeling of resentment directed at the social worker. In the new service, where constant contact will be the order of the day, necessity demands a cordial understanding and full cooperation. In such contacts, the intelligent practitioner will soon begin to realize that his and the community's best safeguard lies in entrusting all questions of financial qualifications for service to the social worker, who has been trained to handle these matters; even as the intelligent social worker will prefer to leave matters of medical practice, procedure and personnel to the responsible judgment of the medical professions.

Sometimes, the social workers, influenced by their own background, have ignored the contributions of the medical professions in the past, the vast amount of free work which they have always done and are doing. Often, they seemed loath for these professions to leave this old tradition of "free care to the indigents." Perhaps the compromise, indicated in many of the negotiations, of a fee scale of one-half the regular low fees, is evidence that both parties to the agreement recognized this psychologic lag and permitted the "free care tradition" to place the purchase of health services for the indigent in a different category from that of those other necessities for which full prices are paid.

Many administrators, while acknowledging the value of such contributed services, when faced with the vast needs of their clients and the limited resources of

their budgets, fell back on the old tradition, feeling that there was little reason why the medical profession should not contribute practically all of the services free or at very low charge. A few, drawn from urban communities and accustomed to dealing with a class of clients sent by tradition to clinics for their physical ills, indicated in their comments that they considered the "physician-patient" relationship an outgrown shibboleth.

STATISTICAL RESULTS OF THE SURVEY

In an endeavor to obtain a picture of the reactions of the professional groups to circular No. 7 and of the present status of the service[1] thereunder, we have circularized all state dental and medical societies, in addition to a number of local groups which were particularly active. The survey was further assisted by access to questionnaires sent out by the American Public Welfare Association and the American Association of Hospital Social Workers.

The response was very gratifying, forty-seven medical and forty-seven state dental societies replying. The first returns were received early in January, while corrections and comments were still coming in when this report was made in April; hence, the survey presents a running picture of shifting scenes, rather than of any permanent arrangements.

Extent of Negotiations.—In the forty-eight states, negotiations had been entered into by thirty-eight state medical societies and twenty-five state dental societies. The dental societies have moved more slowly, partly because the relief administrators have stressed the medical angle as more important, and partly because the medical societies were more prepared. *The Journal of the American Medical Association* presented the details of the plan to the members of that Association in September, 1933; while no such general statement was given officially to the dentists.

Although the act placed the first responsibility for negotiations on the relief administrations, thirty out of the medical societies made the first advance and nine of the state dental societies took the first step. This initiative indicates the readiness on the part of these professions to meet the demands implied in circular No. 7 and an acceptance of the principle of the new method of payment. Fears gave way when action was called for, as indicated in the reply of one society: "We realize the dangerous ground we were treading on; namely panel dentistry, but with a population of 70,000 and having 32,000 on relief, something had to be done."

The term "satisfactory" or "successful" which will be applied to the arrangements in certain states in this study should be considered relative, indicating merely arrival at a working agreement which seems to be progressing without enough discord seriously to hamper the program; combined with cooperative ability to adjust differences as they arise. Aside from medical-dental-administrative disagreements, other reasons for failure to attain a successful program have been lack of funds, legal difficulties, lack of interest and lack of facilities. The statement that twenty-one states seem, as of May 1, to have arrived at a satisfactory program does not indicate that such a set-up will continue to be satisfactory. Several states which were in the success column today were not there yesterday and will not be there tomorrow, while some states, now apparent failures, may

1. Throughout this survey, to avoid repetition of the phrase "physicians and dentists," the term "physician," unless specifically exempted, may be understood to include "dentist." Similarly, unless otherwise stated, "medical care" includes "dental care."

seem outstanding successes in six months. Of these twenty-one, twelve have been included during the past six weeks, indicating a marked tendency toward adjustment of difficulties.

Fee Schedules.—The first step in negotiations is ordinarily presentation of a fee schedule. Thirty-two of the forty-eight medical societies presented such a schedule before any had been advanced by the relief administration, while seventeen of the forty-seven dental societies made a similar move. Of the thirty-two medical schedules presented, twenty-one were accepted by the component groups, of which was rejected by the component societies. In only ten states have the state and most of the local groups of both professional societies and relief agencies approved the fee schedules. In ten more states, the medical schedule alone has received such approval, while in two states the dental schedule is accepted although the medical is not.

The phrase of the original act, "provision of good medical service at a low cost . . . to the mutual benefit of indigent patient, physician, nurse, dentist, and taxpayer," has seemed open to a host of interpretations, ranging from fee scales very

TABLE 1.—FEES ON MEDICAL SCHEDULES APPROVED BY FERA

Type of Service	Number Reporting	Fees		
		Minimum	Maximum	Average
Office calls	25	$0.50	$1.25	$0.89
House calls by day	26	1.00	2.00	1.56
House calls by night	26	1.00	3.50	1.89
Mileage allowance, one way beyond two miles from office or outside city limits	20	0.00	0.80	0.18
Obstetrical, normal delivery with required visits	25	10.00	30.00	16.20
Obstetrical, instrument or other abnormal	23	10.00	50.00	19.44
Fractures, minimum	4	1.00	10.00	4.00
Fractures, maximum	6	10.00	50.00	28.75
Surgery, minor, minimum	10	1.00	10.00	3.75
Surgery, minor, maximum	10	3.00	12.50	5.35
Surgery, major, minimum	10	12.50	50.00	26.00
Surgery, major, maximum	10	20.00	50.00	33.50

eight were rejected and three are under consideration. Of the seventeen state dental society schedules, fourteen were accepted by the local groups, two were rejected and one is still pending. One dental schedule presented first by the Relief Administration has been accepted by the local groups. In twenty-three states, the administration has accepted the state medical fee schedule, but in the meantime in two of these states, the local societies have rejected the same schedule. Of the dental fee schedules, eleven have been accepted by the state administrations, one near the regular rates through 40, 50, and 80 per cent discount to such nominal charges as 50 cents for an office visit and 25 cents per extraction. Recent revisions of fee schedules indicate an upward trend in rates. The fee range and averages for medical services are indicated in Table 1. The variation in number of reports is due to the fact that many states do not authorize all of the services included except upon an individual basis, the fee to be arranged at that time.

The variation in dental schedules is presented in Table 2. Of these schedules,

TABLE 2.—DENTAL SCHEDULES APPROVED BY FERA, ARRANGED BY STATES*

Type of Service	States (Indicated by Numbers Only)												FEES		
	1	2†	3†	4	5	6†	7	8†	9	10†	11	12†	Minimum	Maximum	Average
Extraction, no anesthetic	$0.75	.....	$1.00	.....	$0.50	$0.50	$0.50	$1.00	$1.00	.....	$1.00	.....	$0.50	$1.00	$0.78
Extraction, local anesthetic	0.75	$2.00	1.00	$2.00	.....	1.00	0.50	1.00	1.00	$2.00	1.00	$2.45	0.50	2.45	1.34
Extraction, general anesthetic	0.75	2.00	.....	2.00	.....	2.00	3.00	1.00	1.00	5.00	.....	2.45	0.75	5.00	2.13
Extraction, extra teeth, each	0.75	1.00	.....	1.00	.....	.....	.....	0.50	1.00	1.00	1.00	0.70	0.50	1.00	0.87
Fillings, amalgam,															
Fillings, 1 surface	.....	2.00	.....	1.50	.....	1.50	.....	.....	.....	2.00	1.00	1.40	1.00	2.00	1.57
Fillings, 2 surface	.....	3.00	.....	2.00	.....	3.00	.....	.....	.....	3.00	2.00	2.80	2.00	3.00	2.63
Fillings, 3 surface	.....	4.00	.....	3.00	.....	4.50	.....	.....	.....	4.00	3.00	4.20	3.00	4.50	3.78
Fillings, silicate	.....	2.50	.....	.....	.....	.....	.....	.....	.....	3.00	2.00	1.40	1.40	3.00	2.26
Fillings, other cements	.....	1.00	.....	1.00	.....	.....	.....	.....	.....	1.00	1.00	.....	1.00	1.00	1.00
Treatments	.....	3.00	2.00	2.00	.....	.....	5.00	.....	.....	2.00	1.50	1.75	1.50	5.00	2.46
Roentgenograms, single	.....	1.00	1.00	1.00	.....	.....	0.50	.....	.....	1.00	1.00	1.40	0.50	1.40	0.99
Roentgenograms, full mouth	.....	5.00	6.00	10.00	.....	.....	.....	.....	.....	7.50	5.00	.....	5.00	10.00	6.70
Impactions	.....	8.00	3.00 to 15.00	10.00	.....	.....	.....	.....	.....	10.00	5.00	17.50	3.00	17.50	9.92
Dentures, full each	.....	30.00	25.00	15.00	.....	.....	.....	.....	.....	30.00	25.00	.....	15.00	30.00	25.00
Dentures, partial, each	.....	35.00	25.00	10.00	.....	.....	.....	.....	.....	30.00	25.00	.....	10.00	35.00	25.00
Dentures, repairs	.....	3.00 to 5.00	3.00	2.00	.....	2.00 to 2.50	3.00	.....	.....	3.00 to 5.00	5.00	3.50	2.00	5.00	3.34
Dentures, added teeth, each	.....	1.00	1.00	1.00	.....	0.50	.....	.....	.....	1.00	0.50	1.00	0.50	1.00	0.86

*To preserve the confidential nature of these scales, they are identified by number, not by name.
†Accepted by dental societies.

although all are in force accepted by the Administration, only those starred have been accepted by the state dental societies.

The statement which applies to this entire survey, that of constant change, applies particularly to these fee schedules, many of which are undergoing alteration at the present time.

Limitations on Types of Services Rendered.—Although the scales cover a wide range of services, it should not be inferred that all of these services are rendered under the existing program. Circular No. 7 specifically limited services to those of an emergency nature. Dental care is restricted to emergency extractions and repairs. In thirty of the states, all medical service aside from home and office calls for acute illnesses and obstetrical care, is on an individual basis. Twelve of the states which have established a medical set-up have as yet no provision for dental care aside from that rendered by already existing agencies, and emergency extractions. Only six states report a rather extensive dental program. Several letters received from relief administrators indicate that these limitations are due rather to lack of funds than deliberate neglect of the importance of dental care, the writers commenting on the unfortunate future effects of so neglecting a generation or resorting to emergency extractions of teeth which might have been saved.

Members of the health professions should perhaps be reminded that, important as the medical features of the FERA program appear to them, these features are but a small part of a very large relief task. Food, shelter, clothing and heat are more immediate needs for the average family on relief. In some states, a total of between $3 and $4 per person on relief per month constituted the available funds for all these items. In the three states for which statistics are available, 1.7, 2.8 and 4.9 per cent of the total relief expenditures are devoted to medical care, although some states which gave little medical care of any sort before the introduction of FERA 7 are estimating this expense at from 10 to 20 per cent of the relief budget. From a federal appropriation of $75,000,000 a month, much the same proportion, $1,000,000, goes to medical care; which indicates that this item is but a portion of the problems of the social worker.

Relations Between Professional Societies and Administration.—Thirty of the medical societies reported that they found the relief administration cooperative; and twelve state dental societies made a similar reply. This comment is particularly interesting because a much smaller number of states have as yet arrived at a workable program. Some of the states making this report were southern states in which some of the bitterest fee battles are raging. Even discounting the tendency of that area to courtesy, such comments as "Friendly, agreeable on many matters, but unbending on question of fee scale"; "Open-minded on all but fee scale"; "Commented favorably on our program, but unable to apply in rural regions," indicate that the adjective is not an empty compliment. "Cooperative" was obviously taken to include the possibility of an honest disagreement, if reasonably arrived at.

At least three state medical and eight state dental societies indicated that they had not accepted the dictum of community responsibility for payment for medical care of the indigent and all that such responsibility would involve, by refusing to have anything to do with the organization proposed under the FERA. Stating their fear of state medicine and the effect of a low fee schedule on the future of the profession, they preferred to contribute what aid they could with-

out charge, rather than be involved in such a system. With the exception of two New England and two Middle Western states, all of these societies are located in the south, and, with one exception, none have large industrial centers within their borders. A number of local societies have similarly refused to take part, even after their state organizations had entered a basic agreement.

This attitude was expressed by one state dental society when it voted to go on record "as being opposed to the . . . attitude of getting, so to speak, 'what is coming to it' from any Federal funds . . ." stating that its members would "continue to render insofar as is possible without compensation, emergency dental relief to the unemployed."

One of the state medical societies was even more definite in its condemnation, stating:

> The . . . Committee of the Medical Society of . . . disapproves of the plan proposed . . . for the compensation of physicians on a fee schedule basis for the care of the indigent sick; and recommends to the various county medical societies that they cooperate with the local relief agencies in working out suitable plans for the . . . care of these cases without charge for services rendered.

Cooperation Between Medical and Dental Organizations.—Twelve societies reported cooperation between state medical and dental organizations in working out a program. This number is a hopeful sign that both organizations are beginning to recognize that their interests are identical.

Reasons for Lack of Success in Installing Program.—Twenty-one states at present appear to have installed programs under FERA 7 successfully.[2] Of the remaining twenty-seven, seven expressed satisfaction with their previously existing program, one was hampered by lack of funds, two are faced with legal bars to the needed appropriations, eight supplied insufficient information and nine are delayed by conflicts between the relief authorities and the medical professions.

Jurisdictional Difficulties.—Although the original circular sought, in the main, to place all administrative and social service functions in administrative hands, while largely reserving the professional fields for professional groups, the clause providing for reinvestigation of the case in the home by local relief workers in case an extension of care is considered necessary by the physician has created confusion. If this clause means reinvestigation from the point of view of finances and social case work, it is sound, but these should not be the sole criterion for further medical treatment. The latter interpretation, employed in some localities, has placed an unfair burden of responsibility in questions of medical care on the social worker and cast a shadow on the right of medical judgment to determine the needed care.

It is sometimes enlightening for us to learn how we are viewed by our associates. One of the most frequent comments made by FERA workers not drawn from the medical professions is that physicians and dentists too often display a tendency to treat a patient first, learn whether he is on relief afterward, and then if he is not on relief, try to get him there. Omitting that small group of professional men who may be trying to get their bad bills settled in this manner, the traditional basis for this procedure is clear. For years, and especially for the past two years, the health professions have been accustomed to rendering service first, then thinking of payment. The mechanics of the new system demands a mental adjustment, whereby the medical

2. Twenty-one of these have medical programs; fourteen have dental programs, within limitations.

professions recognize the professional training and superior judgment of the social worker in this field.

More serious is the comment often made which deals with professional ethics, and states that members of the professions, lacking in regard for the rights of their fellow members, are guilty of using the provision for free choice of physician or dentist by the patient as an excuse for campaigning to acquire another man's patients. Sometimes, the offender is a city or county physician; sometimes, he is an individual who, because of racial, political or other affiliations, is in a position to exert undue influence on relief clients. A badly drawn program forces the social worker either to interfere with free choice by the patient, or to permit both clients and profession to suffer because of a single individual. This problem should be settled in the beginning by placing the responsibility of allocation and discipline where it belongs, upon the organized medical profession.

A similar situation arises regarding questions of medical practice. The circular limited the medicines and services which might be employed to the most inexpensive except in cases of emergency or necessity. The question as to who should decide when such an emergency has arisen has too frequently been left in midair. One administrator commented: "My greatest difficulty is in knowing how to judge the bills . . . some seem too high, others too low. But I do not know enough about these matters to do anything." Nor should he be expected to. This question, as well as the related questions of over-treatment, failure to hospitalize, etc., should be under the review, not of laymen, but of the profession concerned.

Relation of Nonmembers of Professional Organizations. — The circular makes the basis of service an "agreement between the relief administration and the organized medical, nursing and dental professions, state and/or local." It also states that "Participation shall be open to all physicians licensed to practice medicine in the State, subject to local statutory limitations and the general policy outlined in regulation 1, above. . . . A similar policy . . . shall be followed in . . . the approved lists of . . . dentists." Various localities have already thought these provisions conflicting, making the organized profession responsible for persons over whom they have little control and in some areas tending to range professional men against each other. At times, when the administrator failed to obtain a satisfactory agreement with the professional society, he has apparently disregarded the terms of the first section of the act and turned to persons not members of the society to carry out his plans. It would appear that the proper interpretation is that while all qualified men may participate if they desire, the organization should control the formal agreement and compile the list. The value of such contacts with nonmembers should be an incentive to action by membership committees of the societies.

Relation of Clinics to the Program.— Still another center of discussion is that of the relation of existing clinics to the program. Circular No. 7 states that the service shall not supplant that offered by existing clinics and similar institutions. On the other hand, it promises the patient free choice of physician. Some localities have ruled that where a patient or a member of his family has been a clinic client within the past twelve months, he must continue to patronize the clinic for ambulatory sickness. Some cities report that patients are deserting clinics for private practice, while others reply that clinics resent treating relief

patients as long as the regulations prohibit payment for such treatments. Reports of the last month indicate a growing tension on this question in various parts of the country.

"Emergency" Nature of the System.—The "emergency" nature of the act is repeatedly stressed in the legislation establishing it and by the medical and dental societies which, when agreeing to participate, have reserved the right to withdraw at any time. Yet the debates waged over the programs indicate clearly that all concerned believe that the precedents now established will be of future importance.

From studies made by me while a member of the Committee on the Costs of Medical Care and from statements made by various professional groups, it is apparent that present procedures are forming a pattern which will not only serve in the "emergency," but will also be utilized in any further extension of medical and dental services contemplating changes in the method of payment. These former studies, with the addition of the present survey, have also forced us to the conclusion that, as both the experience of other countries and of the United States under circular No. 7 have indicated, although the medical professions may object strongly to the wide theoretical implications of state medicine or a panel system, the inaugural of governmental machinery which provides due recognition of professional standards and responsibilities goes far to transfer the discussion from the realms of the theoretical to the practical.

This reaction was foreshadowed in England, where the British Medical Association overwhelmingly condemned certain features of the sickness insurance act before its passage. When, in spite of this opposition, it became law, the physicians immediately rushed to cooperate, arguing only over such modifications as might affect their income and professional duties to their patients.

Under these circumstances, the erection of proper machinery and due demarcation of jurisdictions become of greater importance than actual fee schedules. When such machinery is lacking, bitter and acrimonious disputes usually result.

CONCLUSIONS AND RECOMMENDATIONS

In circular No. 7, the government endeavored to provide for professional recognition, and, as this survey has indicated, the response of the medical professions has been, on the whole, remarkably realistic and practical. The chief centers of argument have not been theoretical, but concerned with working details: fee schedules, jurisdiction and day-by-day routine.

As a running picture, this survey has disclosed that any such medical-governmental cooperation in caring for indigent health needs must include the two fundamental principles enunciated in circular 7: recognition of professional capacity and responsibility for enforcing professional standards and policies, and recognition of the principle that professional services should not longer be expected as free gifts but should be paid for in accordance with the ability of the community. Practical experience has also indicated the need for careful apportionment of jurisdiction between administration, social worker and medical professions. Physicians and dentists must give due recognition to the professional training and ethics of the social worker and leave to that worker all questions regarding the financial and social status of the patient and to the administration the question of the amount of funds to be allocated to health service. On the other hand, the welfare of both patients and medical professions demands that questions concern-

ing medical procedure and practice must be controlled by the organized professions trained to deal with them.

In outline, such a program would demand that:

1. All questions regarding the amount of funds and amount of service the community will pay for be settled by the administrative authority.[2]

2. All questions regarding the financial and social eligibility of the patient be settled by the social worker.

3. Case worker or medical social service worker issue medical service authorization cards to persons needing care.

4. Once these cards are issued, the patient rest completely in the hands of the organized health professions, which would be responsible for preparation of the list of practitioners, including all eligible and allocation of patients thereto, permitting free choice. Decision as to type and amount of service needed within the agreed scope of service would rest in the hands of the individual physicians, subject to review only by his professional society, which assumes responsibility therefor.

It might prove a wise social policy, once the administrative authority had made the budgetary decision mentioned above, for the professional society to be given the responsibility for spending these funds wisely and with the greatest benefit to the patients concerned.

All questions of discipline, of medical procedure and practice would rest solely in the hands of the organized profession, which shall assume responsibility therefor.

2. Under the old tradition of free care, the medical profession decided what would constitute adequate service. The administrator, employing public funds, must determine the amount of service thereby, but it should be clearly understood that there is often a wide difference between professional and administrative concepts of adequacy.

The Chicago Dental Society has employed this plan. As soon as an investigation by the social service division has shown a patient to be eligible for service, that division turns him and his authorization over to the Emergency Dental Relief Committee of the society. At the beginning of the fiscal year, this committee has been informed as to how much money will be available to meet the dental needs of indigents and has arranged its agreed-to fee schedule accordingly. The committee sends the authorized patient to a dentist included on a list which it has prepared, and also draws the checks for his payment. Not until a patient's slip has been marked "finished" does he return to the social worker, who has no power of review over the work, merely recording the fact of its accomplishment.

The Chicago Dental Society, recognizing the importance of professional approach to community health problems, has endeavored for a number of years to develop a leadership in its members which might meet the increasing measure of such problems. Hence, when the occasion arose, this leadership was not only prepared, but also was accepted by the comunity. Medical and dental societies which have made no such preparation, which have evinced few signs of a professional approach to community health problems, need not be surprised if the community in turn is at first suspicious of their motives and doubtful of their abilities. Perhaps one of the chief advantages of FERA circular 7 is that it has paved the way for professional men to work closely with groups of laymen and social workers, helping each to understand the viewpoint and problems of the other.

In discussing jurisdictional matters, it should be emphasized that all relations across professional lines must be from organization to organization, not from individual to individual. When individual

dentist or physician differs with individual social worker or administrator, principles disappear, while personalities enter in. All disputed points must be referred from the representative of the other.

The federal character of this care under FERA circular 7 makes advisable the formation of a group of representatives appointed by the national professional organizations concerned, to confer with and advise with representatives of the government, explaining the meaning and importance of professional standards and the best means of routing them through the system. Similar state and local groups should deal with their related problems.

The experience of the Chicago Dental Society and that of other places has indicated that the task of administering medical service in a large city is too heavy for either justice or efficiency to permit that a volunteer member of the profession be required to do it without payment. In at least three communities either full-time or part-time paid employment of a member of the professions, chosen by the society, has found necessary. In two cases, salaries were paid by the society; in the third, by the community.

Frequently, the handling of professional functions has gone to the social service workers and relief administrators by default, simply because the professions were unable or unwilling to provide the machinery therefor. The retention of these functions in the hands of the health professions is too important to our future for such neglect. The men who do this work, whether volunteers or paid, are rendering us all a great professional service.

But before such groups can be effective, we must have continuous fact-finding information bodies within our professional organizations. We have seen how, because of early information and a well-organized national economic bureau, the state medical societies were prepared to meet the state FERA administrators in discussing cooperation under the provisions of this circular. We have also seen how the dental societies were unfortunately less prepared. That other professions consider such agencies of vital importance is indicated in a recent publication of the American Public Welfare Association, wherein the statement is made: Here [referring to their own bureau] is an agency watching matters of general concern [to all public welfare workers] and equipped with facilities for gathering information which are not available to many . . . it should be a source of gratification to social workers that in their field the New Deal has meant from its inception consultation with leaders in the profession, a recognition of their professional competence, and of the value of their professional approach and the enactment of legislation for which they have pleaded for years.[3]

If the dental profession is less happy in the changes which have overtaken it; if it feels bewildered, uncertain as to its proper course of action; if it is unwittingly the subject of criticism because of contradictory methods of meeting the present situation, certainly the individual dentists or local societies are not at fault. We have been called to solve a complicated problem lacking the simplest of modern equipment fitted to the task.

3. Unemployment Relief Administration, Stevenson, Marietta, and Brown, Lucy: American Public Welfare Association. Quotation from Foreword and page 1.

INDIAN DENTAL SERVICE

By FRANK C. CADY, D.D.S.,* Washington, D. C.

WITH the exception of sporadic service by missionaries, all medical and dental treatment for the American Indian prior to 1873 was furnished by the "medicine man" or "medicine woman."

In general, the various tribes show many similarities in regard to treatment, but the actual agents employed differ with the tribes and localities, as well as with individual healers. Magic, prayers, songs, exhortation, suggestion, ceremonies, fetishes and certain specifics and mechanical processes are employed only by the medicine men or medicine women.

The use of magic consists in opposing a supposed malign influence, such as that of a sorcerer, spirits of the dead and mythical animals, by the supernatural power of the healer's fetishes and other means. Prayers are addressed to benevolent deities and spirits, invoking their aid. Healing songs, consisting of prayers or exhortations, are sung. Harangues are directed to evil spirits supposed to cause the sickness, and often are accentuated by noises to frighten such spirits away. Suggestion is exercised in many ways directly and indirectly. Curative ceremonies usually combine all or most of the agencies mentioned. Some of them, such as those Matthews describes among the Navahoes, are very elaborate, prolonged and costly. The fetishes used are peculiarly shaped stones or wooden objects, lightning-riven wood, feathers, claws, hair, figurines of mythical animals, representations of the sun, or lightning, and are supposed to embody a mysterious power capable of preventing disease or of counteracting its effects. Mechanical means of curing consist of rubbing, pressure with the hands or feet, or with a sash or cord (as in labor or in painful affections of the chest), bone-setting, cutting, cauterizing, scarifying, cupping (by sucking), blood-letting, poulticing, sucking of snake poison or abscesses, counter-irritation, tooth pulling, bandaging, etc.[1]

Though the medicine man continues to be an important factor in the life of the American Indian, contact with the white man has largely replaced him.

Prior to the present time, the Indian required little, if any, dental treatment, but in common with all aborigines, contact with civilization and a carbohydrate diet introduced a common dental problem.

Organized medical service was not provided for the ward Indians by the Government until 1873. The Indian Dental Service was organized in 1913, with five dentists, on a traveling status. These men were assigned to specified districts, and visited Indian reservations with portable dental equipment.

From 1913 to 1922, dentists of the Indian Service were under the Indian Office, Division of Education. In 1922, the Health Division of the Indian Service was organized, and traveling dentists

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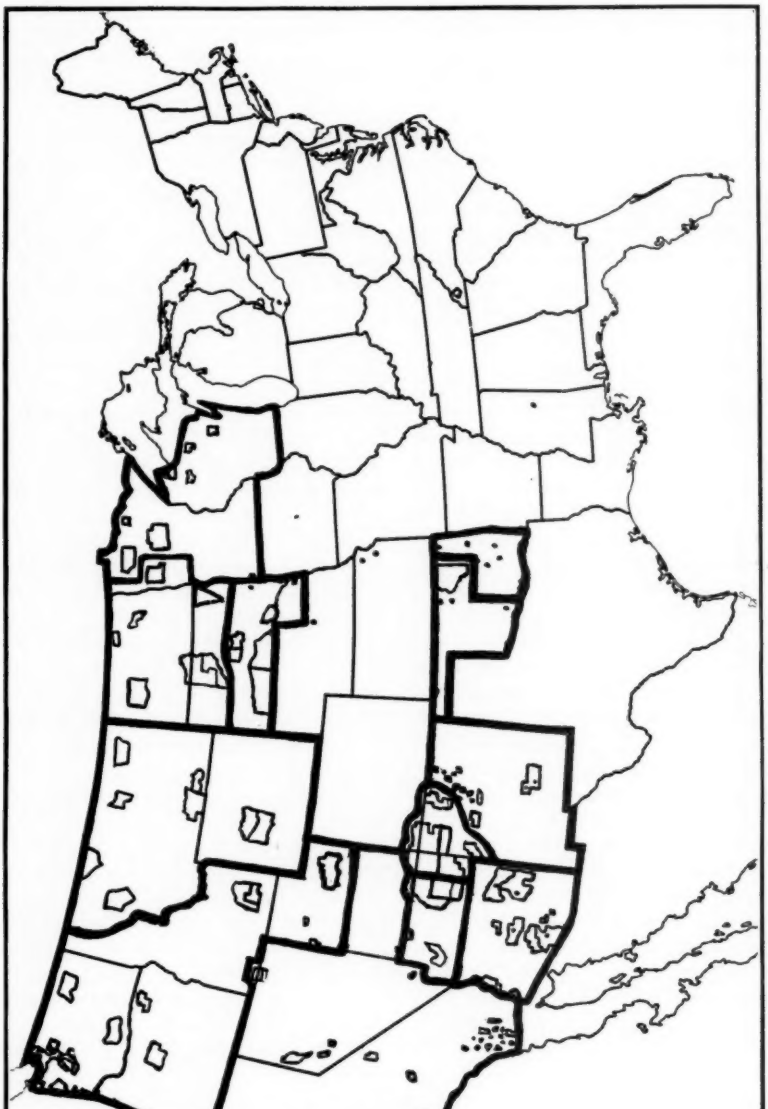
1. Bull. 30, Bureau of American Ethnology, 1910.



Indian reservations in the United States and the twelve dental districts of the Indian Service.

were placed under its supervision. During this period, a few local practicing dentists were also employed on a part-time basis to serve children of the larger boarding schools. These part-time dentists were supervised by the Division of Education until a dental section of the Division of Health was established, in September, 1932.

At present, the Health Division is directed by a medical officer detailed from the U. S. Public Health Service. In September, 1932, at the request of the Commissioner of Indian Affairs, the United States Public Health Service detailed a dental officer to reorganize and supervise the Indian Dental Service.

At present, the dental personnel is composed of twelve full-time traveling dentists and ten part-time resident dentists operating in twenty states. They attempt to serve approximately 260,000 Indians, of which about 100,000 are school children in more than 900 schools.[2]

With the exception of Alaska, the districts covered by each full-time traveling dentist are shown on the map and outlined by the heavy lines. In establishing these districts, consideration was given to accessibility of the various reservations, and to the Indian population. The largest district from the standpoint of area is Alaska. The smallest district is made up of the northeastern corner of Arizona, the northwestern corner of New Mexico and a few reservations in southern Utah and Colorado.

The Alaska Division was transferred to the Indian Service from the Office of Education, Department of the Interior, in 1931. The field dentist, who is under the immediate supervision of the director of the Alaska Medical Service, devotes a greater part of his time to work at the native schools and hospitals. In 1932, the Indian Service operated in Alaska 101 day schools, three boarding schools and six hospitals. There were 4,358 pupils enrolled in these schools, and 1,686 pupils enrolled in territorial and religious schools, a total enrollment of 7,044, consisting chiefly of Eskimos, Indians and Aleuts.[3] The Eskimos are confined mostly to the Northwest, the Indians are in the Interior and the Southeast, and the Aleuts inhabit the Aleutian chain of islands to the Southeast. Considering the fact that the Alaska natives are scattered over a rugged area, one fifth the size of the United States, it is easily understood that with only one dentist, these people are getting a very meager and entirely inadequate dental service. In order to visit as many native schools as possible, the Alaska field dentist utilizes whatever transportation is available, whether ship, airplane, automobile or dog sled.

Although there is considerable difference in the size of the various districts of the mainland, accessibility and Indian population tend to equalize the problem. Consequently, the Indians of California receive approximately the same service as those in northwestern New Mexico.

Field dentists in the states use mostly motor transportation. In the west, many of the reservations are far from railroads and with but few improved roads. The Havasupai Reservation, for instance, is in a canyon of the Colorado River, miles from the railroad at Grand Canyon. To visit this reservation, the dentist takes an automobile for 38 miles and travels the remaining 14 miles down the canyon by mule or pony. He is able to take with him a maximum of 50 pounds of baggage and equipment, which is transported by a pack animal.

Through the intense heat of the Arizona Desert and the extreme cold of the Alaskan Mountains, these dentists travel

2. Rep. Committee on Indian Affairs, 1932. Bull. Dept. Interior, Feb. 15, 1933.

3. Footnote 2, second reference.

from year to year, in season and out, to relieve suffering and provide a small measure of dental service.

Each of these itinerant dentists serves a district containing approximately 15,000 widely scattered Indians living in inaccessible places. Treatment is of necessity limited in scope and spread very thin. The majority of the patients are school children, who are concentrated and accessible during school months. The dentist visits as many schools as possible each year. The number visited is dependent on such things as weather, roads and the amount of treatment necessary.

Portable equipment is set up in the most convenient place, whether it be a hospital room, school room or adobe shack, and the pupils are called in until all have been examined and treated as needed.

With limited dental personnel, the Indian Office considers that, in this manner, the greatest good is being accomplished.

In addition to rendering treatment, field dentists of the Indian Service instruct teachers, supervisors and nurses in the principles of dental health education. Lectures and talks are given to pupils and their facilities for mouth hygiene supervised and inspected.

Toothbrush cabinets are provided in the boarding schools for the pupils of the lower grades. The Office of Indian Affairs furnishes specifications and blueprints for a standard toothbrush cabinet. This cabinet is so constructed that each row of brushes is offset to prevent dripping from one row to those below. Fine mesh screen is inserted in each end for ventilation. Toothbrushes, both large and small sizes, are provided by the Indian Service. These brushes are first quality, and are required to meet rigid government specifications. A dentifrice, usually in the form of powder and of known and accepted formula, is supplied in sufficient quantity. Morning and evening brushing under the supervision of matron or teacher is required of each pupil. Pupils of day schools who live at home are issued brushes and dentifrice which they use at home. The care and use of these articles is followed up by the field nurse, who visits each home periodically.

With some exceptions, the incidence of dental defects in Indian children is comparable to that of white children of similar environment. Some of the tribes in the Southwest, particularly the Navahoes, have a very low incidence of dental caries. The condition of the teeth of children in the Indian boarding and day schools that receive periodic service from traveling and resident dentists will compare favorably with that of any group of white children.

Many of the Indian Reservations of the Southwest are in the endemic area of mottled enamel, consequently certain sections of Hopi, Fort Apache, Fort Mohave, Colorado River, Pima, Papago and Mission Agencies demonstrate a high percentage of this hypoplasia. The latest report shows thirteen known endemic mottled areas in Indian country.[4]

Endemic water containing fluorides is confined largely to surface wells and the Bill Williams, Little Colorado, San Juan, Salt and Gila rivers. Analysis of the Colorado River water has shown a small amount of fluorides, but whether the concentration is enough to be endemic has not been definitely determined.

The incidence of dental defects among adult Indians is high. Primarily, this is probably due to change of environment and diet; secondarily, to isolation, economic conditions, lack of education and dental facilities.

A recent survey of the Cherokee Indians of North Carolina conducted jointly by the North Carolina State Health De-

4. Dean, H. T.: U. S. Pub. Health Rep., Vol. 48, No. 25.

partment and the Indian Dental Service shows the following dental conditions on that reservation: number of examinations, 1,155; normal, 355; number with dental defects, 800. The greater number of those found to be normal are school children who have been receiving periodic dental service at the schools.

That educational programs sponsored by the field dentists and carried out by them as well as physicians, teachers and field nurses in Indian Schools are bearing fruit is witnessed by the following incident. At the Hopi Reservation in Arizona, there are five scattered Indian day-schools. The field dentist having established his clinic in the reservation hospital at headquarters, it was necessary for the field nurse to round up the children of these schools requiring dental treatment and stimulate interest in the necessity for visiting the clinic. In this instance, the response was gratifying, as, in addition to many school children, forty-seven adults took advantage of the opportunity, some making many long trips. Many adults brought children in their own cars, one bringing two of his own children and nine others on one trip.

A very encouraging sign is noted in a dental report from the Leupp Reservation Boarding School, Leupp, Ariz. This school had an average of 350 pupils of from 6 to 18 years of age. Notwithstanding the fact that the number of new pupils requiring treatment increased from 63.63 per cent in 1930 to 78.08 per cent in 1933, the rate of dental defects for the entire school decreased from 44.08 per cent in 1930 to 24.24 per cent in early 1933. The field dentist had been able to make annual visits to this school during the period.

The following 1933 reports from schools of the same size demonstrate clearly the success of periodic dental service. For the past four years, the Indian Boarding School at Hartshorne, Okla., has been visited by the field dentist at least once every school year. The last report from this school is as follows: number of examinations, 180; normal, 128; number with dental defects, 52.

The school at Scottsdale, Salt River Reservation, Ariz., has only averaged a visit from the field dentist once in two years for the last four years. The last report is as follows: number of examinations, 184; normal, 66; number of dental defects, 118.

It will be noted that the percentage of normal cases at Hartshorne are approximately 66⅔ against 33⅓ for Scottsdale. Age, diet and general living conditions at these two schools are similar.

I recently returned from an inspection trip to some of the reservations of New Mexico and Arizona. Examination was made of 2,630 Indian school children.[5] The following figures show clearly the incidence of dental caries among them: age group, 6 to 18 years: pupils examined, 2,630; pupils with caries, 692; pupils without caries, 1,948.

This comparatively low incidence of dental caries is due to conditions among the Pima, Apache and particularly the Navaho tribes. These three tribes are the best of all from a dental standpoint. The opposite is true of the Pueblos, who have a high incidence of dental caries. Of the 2,630 examined in the southwest, 533 were Pueblos. Of this number, 292 were found to have dental caries. (A recent examination of 1,306 Northern and Southern Pueblo Indian school children shows 60 per cent with dental caries. This examination was made by the field dentist of that district with mirror and explorer.) Comparison with the foregoing figures shows that while approxi-

5. These examinations were made with only the use of a tongue depressor and are, therefore, approximate.

mately 25 per cent of the total examined were Pueblos, more than 40 per cent of those having dental caries were from this tribe. Considerable hypertrophy of gum tissue was observed in all school children, though the percentage of salivary deposits is low. Observations and reports indicate that there is a high rate of chronic, low grade Vincent's infection prevalent among the entire Indian population of the country.

The greater percentage of defects is in the deciduous teeth of the younger age groups. This is clearly demonstrated by a comparison of the results of this survey among the Southern Pueblo Indians of New Mexico: age group, 6 to 11 years: pupils examined, 317; pupils with caries, 231; pupils without caries, 86; age group, 11 to 16 years: pupils examined, 146; pupils with caries, 67; pupils without caries, 79.

Notwithstanding the handicap of insufficient personnel who are working under adverse conditions and with inadequate equipment, it is felt that the dental service has been an important factor in the well-being of the American Indian. The value of this service is clearly demonstrated when a comparison is made of the dental condition of older Indians whose teeth were neglected in youth and who since have received sporadic service, and those of the younger groups who have received fairly regular dental treatment and education in dental hygiene.

TRAVELING DENTAL SERVICE IN MASSACHUSETTS

By ELEANOR G. McCARTHY, D.H., Boston, Mass.

EVEN the briefest study of a map showing the traveling dental services in Massachusetts reveals at once three aspects that are characteristic of all phases of our public health work here: first, individualization of program; second, local support; third, the operation of crude programs simultaneously with those of greater sophistication and developed later.

In Essex County, the dentist is more or less a free lance. In Hampshire and Franklin counties, the work is directed by the Red Cross; in Worcester County, by the extension service, and in Southern Berkshire and Barnstable counties, by the health districts.

The clinic in Middlesex and Essex counties is a remnant of a more elaborate one started by the Middlesex County Farm Bureau about 1920. This clinic is the simplest of the services. A dentist, with portable equipment, visits these towns and makes examinations, working at $2.50 an hour on those children whose parents request dental care. Little or no effort is made to restrict the group. The dentist has assistance from the local nurses. I would call this a reasonably priced family dentist's service rather than a clinic. It has little to do with a public health program, other than serving as a means of securing the much desired correction of dental defects among school children. It has one good point, that it is almost always sponsored by a local organization, which sometimes raises money for the needy children, either by private subscription or by public appropriation.

The Worcester County Clinic, of about the same vintage, is somewhat similar,

with the following improvements: It is sponsored and directed by the county extension service, which explains the service to interested communities, lends the equipment, secures the services of a suitable dentist and plans his itinerary. The fee is $2.50 an hour. The local organization sponsoring the clinic buys the necessary supplies, helps pay the fees for indigent children and usually pays the dentist to examine all the school children so that the parents may know what work is needed. This service is a definite part of the organized local health program.

In a study of the growth and development of traveling service, we should next describe the Hampshire County Red Cross clinic. Here, the supplies are purchased by the Red Cross, and the fees put on an operative basis of 60 cents each for filling, extraction and cleaning. (In the case of several deciduous extractions or pit and fissure fillings, this charge is often reduced.) The Red Cross pays 50 cents of this fee to the dentist as salary and keeps 10 cents for supplies. (The average cost of supplies per operation over a period of two years has been 10 cents.) A few preschool children receive care. The clinic is definitely "cash and carry." Records are kept for the Red Cross and the state health department. The assistance is still given by the local nurse with practically no use of lay committees.

The Franklin County Red Cross has adopted the Hampshire County plan. In Barnstable County, the Cape Cod Health Bureau lends portable dental equipment, letting the individual towns secure the operator. Two of the Cape Cod towns have borrowed the Hampshire County dentists and adopted the general plan of operation.

The Southern Berkshire Health District clinic represents the best of the Hampshire County plan, with several additional refinements, because it is an integral part of the local district, and state, health program. It is part of a generalized dental health educational program planned around the dental hygienist and public health nurses on the staff of the health district. The dental hygienist inspects the mouths of all children (school and preschool) at well child conferences. She sends the parents a general notification of the need of dental care and the parents reply (on the card) as to whether or not they plan to have this dental work done by their own dentists. (It might be well to add here that all these services are planned for the community with no resident dentist.) If the parents state definitely that they are unable to have the work done, the children are examined by the traveling clinic dentist when he reaches the town.

As would be expected, here we find the use of local health committees for organization and lay volunteers to assist the dentist, keep records and collect the fees. The dental hygienist helps the public health nurse with the preliminary community organization and is responsible for instructing the lay committee in the duties of assisting. She sees that preschool children as well as school children are cared for.

This clinic is planned on a six months rather than once a year schedule. It serves other communities outside the district to complete a full school year for the operator. When outside the district, the clinic is under the general guidance of the state department of public health. Every effort is made to make this service sound from the point of view of the practicing dentist, sound economics and efficient public health administration. Though quite frankly corrective, it is part of a dental health educational program.

Room 545, State House.

CURRENT LITERATURE

Necessity for Revising the Common Conception of Focal Infection (Myer Solis-Cohen, J.A.M.A., April 7, 1934): Solis-Cohen says the common conception of focal infection implicates the infected tissue, as the tonsils or teeth, rather than the infecting bacteria. Analogously, the opening and draining of an infected cavity fails of the desired result. He illustrates his point by saying that the removal of infected tonsils does not remove the bacteria. Foci of infection in nasal accessory sinuses are not eliminated by treatment or operation. Nor are foci of the oral cavity eliminated by the exodontist. Residual infected tissue is often overlooked. He points to recoveries following removal of foci and also the disappointments, which are all too numerous. He advises that, before making a diagnosis of focal infection, one must be certain that the condition is not due to allergy, lack of vitamins or endocrine dysfunction. The conception of focal infection should stress the bacterial element. The elimination requires the production of bactericidins and other antibodies to destroy the bacteria and make their toxins harmless.

Malpractice—As an Attorney Sees It (R. E. Swing, California and West. Med., April, 1934): Swing asserts that few lawyers, fewer medical men and no laymen understand the conditions under which a physician or dentist is liable. Such liability is predicated upon a negligence termed malpractice, which means unskilled practice resulting in injury to the patient. He discusses civil liability and gives commonest causes. Few actions are predicated on lack of skill or knowledge. He emphasizes the value of consultation, of refraining from criticism of another practitioner, of caution in using new methods, of guidance and training of assistants. He discusses the degree of professional skill required, expert professional testimony, negligence as a cause of injury, responsibility for assistance, protection of professional men in work in charity institutions and unwarranted captious criticism. He concludes that criticism is a fertile seed for retaliation against imaginary wrong. A patient so minded readily finds a designing or misguided lawyer to abet him. According to a fellow practitioner the benefit of the doubt will result in suppression of suits in large measure.

Foreign Literature

Lesions of the Eye Associated with Dental Foci (E. A. Suckling and D. J. Martin, New Zealand D. J., March, 1934): Two case histories are given. In the first case, acute iritis of the left eye, local treatments availed nothing. Roentgenograms revealed infection of the upper left first bicuspid and lower first molar. Removal of these was followed by "spectacular" recovery. In the second, the eyes felt as if full of sand on waking. The patient had been in poor health for two months. Shortly, a swelling in the submaxillary region developed, with septicemia, edema of the face and acute conjunctivitis. The patient was hospitalized for fifteen months, receiving every possible local treatment including vaccine from streptococcus and staphylococcus obtained from the eyes, silver nitrate and ray treatments, with no result. Vision was lost. The cornea was hazy with small ulcers. A slight swelling appeared in the upper right cuspid region. Roentgenograms of the apparently edentulous jaws were made, disclosing an impacted cuspid and root fragments. These were removed. A severe reaction followed for ten days, the eye condition becoming acute. Recovery was gradual both of eyes and of general health.

Eye Diseases and Dental Sepsis (J. Wharton, Brit. D. J., April 3, 1934): Wharton gives a complete bibliography of contributions, with illustrative comment and instances. He lists twelve eye dis-

eases as caused by dental sepsis, with a description of each. His conclusions are that the infection is usually on the same side and that the upper jaw is responsible for more infection than the lower. As compared with other foci of infection, dental infection ranks first. He quotes Gill, who says oral infection is eight times as frequent as tonsillar infection.

Presentation of Films Illustrating Plastic Surgery (Gerard Maurel, Rev. Odontologique, March, 1934): The author points out that the possibilities of reparative and esthetic plastic surgery are numerous. He presents films illustrating operations for treatment of deformed ears, neck scars, bucconasal and buccosinusal communications and for correction of wrinkles of face and neck. He believes that the technic for these operations should be standardized. Contrary to the usual procedure in such demonstration, he discusses the details of technic for each operation, while his films show the various operative stages with the results obtained.

Gingivodental Hemorrhages in Patients with Hepatic Disturbances (A. Pont, Semaine Dent., March 25, 1934): The author points out the vicious circle existing between gingivodental infections and hepatic infections. The presence of one of these conditions should lead to a search for the other. The signs are of two kinds, clinical, which may be determined with the patient in the chair, and laboratory, which may be diagnosis by means of tests (the Maillard coefficient, alimentary glycosuria, etc.,). In all hepatic patients or in those with pyorrhea with involvement of the liver, spontaneous hemorrhages of the gums may be observed with simultaneous hepatic attacks. These hemorrhages are not serious and they may be a valuable aid in diagnosis, furnishing a warning should surgical intervention be necessary. In hepatic patients, oral surgery should be avoided whenever possible, but if an operation is found to be necessary, general anesthesia should not be given. In light cases of hepatic insufficiency, calcium chloride may be administered for two or three days before the operation. In more serious form, blood serum injections should be made. If, in spite of these precautions, there is a hemorrhage, caustic medicaments and electrocoagulation should never be used. A simple tamponment should be employed and an appropriate general treatment followed. If the hemorrhage is very profuse a blood transfusion is advised.

Neutropenia Following Amidopyrine—Preliminary Report (A. M. Hoffman, E. M. Butt and N. G. Hickey, J.A.M.A., April 4, 1934): The number of cases reported recently of malignant neutropenia and the drugs, organisms and toxins that have been associated with it plus the lack of confirmatory clinical and experimental data gave rise to this investigation. The authors give a review of reports and promise the results of their animal experiments later. They state that their work points to amidopyrine as having a definite effect on myeloblastic tissue, similar in man and in rabbit. Whether this is an individual susceptibility of the nature of an allergic reaction remains to be determined.

Localization of Lead Sulphide in the Gingivae (M. Herrmann, Viertelahrsschr. f. Zahnheilk., 49: 1, 1933): In one acute and one chronic clinical case of lead poisoning, a microscopic study of the gingivae was made. The latter showed on the basis of chemical and histochemical examination deposits of lead sulphide. The localization of the lead sulphide differed in each case. In the chronic case, the deposits were found in the papillary stroma, the histocytes and especially the walls of the blood vessels. In the acute cases, the deposits were at the boundary between epithelium and connective tissue, in the intercellular spaces and in the epithelial cells.

Etiology of So-Called Caries in Teeth of Dermoid Cysts of Ovary (D. Tittel, Vierteljahrsschr. f. Zahnheilk, 49:299, 1933): The coronal defects in the teeth of dermoid cysts of the ovary are due to a primary dystrophy of the parablasts. Resorption occurs before the tooth enters the lumen of the cyst. The decalcifying effect of the cyst contents is therefore not a primary factor in production of coronal defect.

An Unusual Case of Jaw Fracture (Max Melchior, Tandlaegebladet, January, 1933): Dr. Melchior is of the opinion that fractures of the maxilla are much more common than most textbooks lead one to believe. In his experience, incomplete fractures are very common, although they are hard to demonstrate roentgenographically. That the fragments are usually in apposition and the soft tissue lesions are insignificant are other reasons that fractures of the maxilla are considered rare. His patient had for two years, after an auto accident, been under the care of nine different physicians for a series of complaints. Severe pains in the left colon, severe pains in the left side of the face, heaviness in the head, deafness in the left ear, constant ear noises, partial paralysis of the left eyelid and impaired memory. Treatment did not help, and statements of the men in charge of the case varied to a great degree. A nerve specialist classed the patient as plainly a neurotic. Examination of the mouth revealed a little lump the size of a pea in the area of the upper left second bicuspid (the upper left third molar was the only tooth present), from which ran a low sharp bony ridge superiorly and posteriorly. Protuberance and ridge were removed and the patient became entirely well and stayed well. Melchior's diagnosis was a reflex neurosis caused by pressure on the nerve ends of the second branch of the trigeminal nerve by the sharp ridge of bone left when a fracture of the maxilla, unnoticed at the time of the accident, healed. He adds that the fifth nerve, owing to its long course in bone canals and its connection with no less than four ganglions, must be considered predisposed to neuralgia.

Balanced Occlusion and Its Importance in the Treatment of Marginal Paradentitis (Gosta Lindblom, Tandlaegebladet, February, 1933): The author presents models, roentgenograms and case histories to show how, in some cases, he succeeded in curing paradental lesions by cusp grinding (his Group 1). His Group 2 involves cases where the height of the bite is normal, but where prosthetic restorations are necessary to restore normal occlusion. Group 3 involves bite raising cases. He is of the opinion that the cases in Group 1 have been generally overlooked and that a little grinding in time will, under certain conditions, save the bite from destruction.

Do Certain Fungi Play a Part in the Formation of Dental Calculus? (Olaf Grythe, Norske Tannlaegefor. Tid., January, 1933): The author discusses the different theories of dental calculus formation, giving a fairly detailed explanation of the theory of Professor Nasland, of Upsala, whose views his own work largely substantiates. Certain types of leptotrix and actinomyces (the author thinks these might be different formations of the same organism) form the stroma for the calculus and by their ability to lower the hydrogen-ion concentration of saliva, they also cause the precipitation of the calcium in the saliva. The illustrations show different forms of the same organisms varying from short rods to ray fungi grown on culture mediums with a p_H varying from 5 to 8. Even in test tubes, the fungi have the ability to lower the p_H of the medium, but only if no carbohydrates that can be fermented are present. This, the author believes, is the reason for the calculus formation at the opening of the salivary duct: the saliva is here free from carbohydrates and the mycelium can cause the precipitation of calcium.

Case of Osteoma in the Maxilla and Some Cases of Circumscribed Sclerotic Smaller Foci in Both Jaws (Johan Rygge, Norske Tannlaegefor. Tid., February, 1933): Dr. Rygge gives a brief discussion of the osteoma presenting one case from his practice. The patient had an osteoma in the region of the right tuberosity causing head pain, which disappeared on the removal of the tumor. The author comes to no conclusion as to the origin of the tumor. He agrees with Riha's views that the sclerotic areas one often finds in either jaw are not neoplastic, but indicative of condensing osteitis. He is of the opinion that these sclerotic foci do not commonly cause the patient any discomfort and should not be removed.

NEWS

ALABAMA

Appointment: H. A. Parks, of Montgomery, has been appointed professor of prosthetic dentistry at the University of Tennessee.

CALIFORNIA

Membership Increases: San Diego County Dental Society announces attainment to a membership of 100 for the first time in its history.

CONNECTICUT

Dr. McManus Honored: The Connecticut State Dental Association dedicated its seventieth annual meeting to Charles McManus, of Hartford, in token of its esteem of his many years of service.

FLORIDA

Membership Campaign: Roscoe D. Cummins, secretary of the state society, reports a 25 per cent increase in paid up membership over last year's.

Dental Examiners Appointed: Fred M. York, of St. Petersburg, and W. G. McLeod, of Pensacola, have been appointed to the state board of dental examiners.

ILLINOIS

Dr. Watt Honored: John R. Watt, thirty-eight years a teacher at the Chicago College of Dental Surgery, was honored at the fifty-first annual meeting of the alumni association in recognition of his long service.

INDIANA

Anniversary: The Indiana State Dental Association marked off seventy-six years of organizational life at its May meeting.

IOWA

Dr. Woodbury Receives Appointment: C. E. Woodbury, of Council Bluffs, has been appointed to the Board of Administration of the School of Dentistry of Creighton University.

Clinics: A dental clinic was held in three grade schools of Atlantic, March 7. Of the 820 pupils examined, 622 were found who needed dental care. Examination of 2,165 children in the Fort Dodge schools revealed that 95 per cent needed dental attention. The Davenport District Dental Society conducted the survey.

MARYLAND

F.A.C.D. Organizes: Fellows of the American College of Dentists in Baltimore organized at a meeting held at the Baltimore Country Club, April 24. Harry E. Kelsey was elected chairman, Louis D. Coriell, vice chairman, and J. Ben Robinson, secretary-treasurer.

Orthodontists Organize: Members of the dental profession in Baltimore and Washington practicing orthodontia exclusively organized at the Lord Baltimore Hotel, April 20, with Harry E. Kelsey, Baltimore, chairman; Herbert C. Hopkins, Washington, vice chairman, and George M. Anderson, Baltimore, secretary-treasurer.

Children's Dentistry Organization: A state unit of the American Society for the Promotion of Children's Dentistry was organized during the annual meeting of the Maryland State Dental Association.

NEBRASKA

Increase in Membership: Membership in the Nebraska State Dental Society has been increased 15 per cent over that of last year at this time, largely as a result of the dental survey. The state dental journal for May will go to all the dentists in the state regardless of membership.

NEW JERSEY

Legislation: The legislative committee has had a bill introduced in the assembly, hereafter to be known as Assembly Bill No. 245. This bill, when introduced, included a number of desired changes in the dental act as set forth in the special state bulletin in March. In order to facilitate the passage of the most vital portion of the

bill, namely the feature aimed to control unethical practices, the committee has amended the original bill to exclude all features except that pertaining to advertising. This clause has been further clarified, specifically stating what advertising practices will not be permitted, instead of giving the state board the discretionary power as in the original bill. All energy will be focused on the passage of this bill. Another bill, Senate Bill No. 165, has been introduced by someone outside the state organization, aiming to grant special privilege of license to practice in New Jersey to those practicing in other states and living in New Jersey a given number of years. The committee is opposing this bill. The examining board, at a meeting held February 7, adopted the following resolution: "*Resolved,* that candidates shall be permitted to take one examination and upon failure to pass, may appear for four reexaminations in conditioned subjects, over a period of five years. Upon further failure to pass, the candidate may make application as a new candidate under the same conditions governing the original application."

NEW YORK

Allied Dental Council Associated with Research Journal: The Allied Dental Council has accepted the invitation of the Journal of Dental Research to became "a member," which affords the subscription privilege of obtaining the *Journal* for $2.50 a year.

Academy Supports Mission: The New York Academy of Dentistry at its February meeting voted the continuance of the scholarship fund for Sir Wilfred Grenfell's Medical Mission in Labrador.

OHIO

Dr. Casto Intern: W. A. Casto has recently been appointed to an internship in the United States Public Health Service and is now stationed at the Marine Hospital in Norfolk, Va.

PENNSYLVANIA

Gerhard Medal Awarded: The Pathological Society of Philadelphia has awarded the William Wood Gerhard Gold Medal to George H. Whipple, dean of the University of Rochester School of Medicine and Dentistry, Rochester, N. Y. Dr. Whipple will deliver the annual conversational lecture of the society, his subject being "Regeneration of Hemoglobin and of Blood Plasma Proteins Controlled by Diet Factors."

RHODE ISLAND

Dr. Miner Honored: L. M. S. Miner, dean of Harvard University Dental School, was presented the Medal of Award for Meritorious Work in Dentistry by the Rhode Island State Dental Society.

TENNESSEE

The state meeting for 1934, which closed April 28, recorded a real advance in membership and in interest. From the retiring president, T. E. Braly, word is received that the goal for paid up membership had been set at 500, and the attendance at 300. At the close of the meeting, the paid membership was 521, and the attendance registered 312. The following officers were elected: J. J. Vaughn, Nashville, president; J. F. Bigger, Memphis, president elect; J. J. Justis, Memphis, secretary-treasurer; Claude R. Wood, Knoxville, editor. Roy O. Elam, Nashville and Claude R. Wood, Knoxville, are the two new delegates to the American Dental Association.

VIRGINIA

College Announcement: The Medical College of Virginia announces the graduation on May 29 of ninety-seven from the department of medicine and twenty-seven from the department of dentistry.

WISCONSIN

August 4 last, an order was given restraining the state board from holding a hearing of malpractice suits on the ground that the law covering such procedure was unconstitutional. January 25, the law was upheld as constitutional, and thus advertising dentists in the state are restrained from quoting advertised fees, and using illuminated signs. An appeal is being made to the Supreme Court to set aside this decision.

GENERAL

Review of Dentistry for Children: This periodical is published "to serve the advancement of dentistry for children and to facilitate and encourage its practice by the private dentist and by public health institutions and agencies." The *Review* plans to present in abstract form original articles and practical procedures in dentistry for children, which is expected to be especially valuable to students and to teachers and essayists on the subject. As the official organ of the American Society for the Promotion of Dentistry for Children, the *Review* contains the business and programs of the society and of its component units. Contributions from the medical profession and from the public are invited to more creditably promote dentistry for children. A few of the 1934 issues to date are available. The subscription rate is $3 a year, but an introductory offer makes the first six issues available for one dollar. The address is 2002 Eaton Tower Bldg., Detroit, Mich.

DEATHS

Baldridge, James S., Sedro-Woolley, Washington; Northwestern University Dental School, 1903; died March 28.

Bay, Earl C., Wallingford, Conn.; Harvard University Dental School, 1924; died recently.

Fowler, Henry, New York City; Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania, 1902; died, March 30.

Gottlieb, Milton, Atlantic City; died, March 13.

Hite, J. Harry, Shelbyville, Ill.; Indiana University School of Dentistry, 1900; died, May 15, of bullet wounds inflicted by a former caretaker of the Shelby Country Club, of which Dr. Hite was a member. The caretaker, who committed suicide, had also shot and killed another member of the club, who, with Dr. Hite, he accused of being instrumental in his dismissal from his position.

Killelea, James Joseph; Cleveland, Ohio; School of Dentistry, Western Reserve University, 1928; died, April 5; aged 35.

Koles, Eli; New York City; New York University College of Dentistry, 1892; died, March 3.

Laity, Matthew H., New Haven, Conn.; Temple University, School of Dentistry, 1904; died recently.

Minner, Edmund E., New York City; New York University College of Dentistry, 1886; died, April 2.

Nipher, Lyman J., Sioux City, Iowa; died, February 26; aged 42.

O'Brien, Edward F., New Haven, Conn.; Baltimore Medical College, Dental Department, 1905; died recently.

Ranger, Carl J., Ithaca, Mich.; School of Dentistry, University of Michigan, 1908; died, March 21; aged 46.

Robinson, W. O., Tyndall, S. D.; died, April 27; aged 88. Dr. Robinson was president of the state society in 1897 and again in 1900 and acted as secretary for several years.

Smith, Joseph A., Worcester, Mass.; Pennsylvania College of Dental Surgery, 1898; died, April 16.

Vineburg, Solomon, Waterbury, Conn.; Medico-Chirurgical College of Philadelphia, Department of Dentistry, 1914; died recently.

Waltz, Amos S., Decatur, Ill.; died, April 30; aged 89.

MISCELLANY

CORRESPONDENCE

GENERAL ANESTHESIA

To the Editor:

Regarding Dr. McKesson's article on "General Anesthesia" in the May issue of THE JOURNAL: First, I cannot conceive why a patient should be subjected to narcosis for the removal of one tooth. I think a grave mistake is made when general anes-

thesia is advocated for the dental profession at large in preference to local anesthesia. Let me refer to George B. Winter's "Technic of Removing Impacted Lower Third Molars." In the hands of Dr. Winter, the technic is perfect, but in the hands of the average dentist, it means fractured mandibles. Likewise, with general anesthesia: one must be proficient in its technic, have a proper armamentarium and assistance, which means that only the highly trained oral surgeons with hospital experience should administer the gas. After all, in every surgical procedure, one must do an artistic job, not only to extract the tooth or eliminate the pathologic condition in question quickly, but to remove the spiculae and to smooth the bone process so that the prosthodontist can give the patient a decent-fitting denture. If the tooth should fracture in its removal, the bone process should not be chopped away indiscriminately in the mad hunt for the root. This difficulty could probably be eliminated if trained anesthetists were to administer all the general anesthetics, *administer* the anesthetics to, but not operate on, the same patient. It is extremely important for a surgeon to have an efficient anesthetist. Under local anesthesia, one can perform the operation without considering the time element very much. I differ with Dr. McKesson about postoperative sequelae in local anesthesia. I believe this has been reduced to a minimum. I can speak for myself in this respect. In twelve years of practice, both in my office and in hospitals, postoperative conditions were negligible. Furthermore, in the past few years, with the perfecting of the solutions, technic, armamentarium and sterilization, one very rarely sees a troublesome postoperative condition, comparatively speaking. All of our patients are examined postoperatively. I cannot conceive of all the ill-effects attributed to procaine administration by Dr. McKesson, and I am sure that most of these conditions are due to other causes. He states that it is impracticable to extract four third molars or a great number of teeth at one time under block anesthesia. The mere fact that it is impracticable is a good reason that it is not sound surgical procedure. One must not forget that not only must the practicability of performing surgical operations be considered, but also that a human being with varying degrees of resistance is the subject of this traumatic torture. I would not mind the patient's dreading each successive removal of teeth as long as success accompanies each operation. Dr. McKesson asserts that in most operations, ambulatory patients are good risks. I believe that he is taking a great deal for granted. I do not consider it good practice to administer general narcosis indiscriminately because the patient is able to walk to the office. I am of the opinion that the patient is entitled to a medical checkup before the anesthesia, and it is for this reason among others that general anesthesia cannot replace procaine at this stage of dentistry. The average dentist is not in a position to find out whether the patient is a good or a bad risk. This requires some medical training. General anesthesia does not occupy an important place in general dentistry. Its use should no more be advocated to the general practitioner than George B. Winter's "technic of removing impacted lower third molars." It may have its place in oral sugery and, if so, should be given by men thoroughly trained in its use.

N. L. Pearson,
Guttenberg, N. J.

Section Meetings at the St. Paul Session

Assurance that the coming annual convention of the American Dental Association at St. Paul, August 6 to 10, will be an outstanding one from a scientific viewpoint has been received from the Chairmen of the eight Scientific Sections. The Section Chairmen have recognized that their presentations, to be of the widest benefit, must appeal to the general practitioner. The following sections, with their Chairmen, will indicate the character of the coming meeting:

Mouth Hygiene and Preventive Dentistry: Chairman, Walter C. McBride, Detroit, Mich.

Full Denture Prosthesis: Chairman, Bert L. Hooper, Lincoln, Nebr.

Periodontia: Chairman, M. Monte Bettman, Portland, Ore.

Partial Denture Prosthesis: Chairman, Ralph C. Cooley, Houston, Texas.

Oral Surgery, Exodontia and Anesthesia: Chairman, Frank W. Rounds, Boston, Mass.

Histology, Physiology, Pathology, Bacteriology and Chemistry: Chairman, Paul C. Kitchin, Columbus, Ohio.

Operative Dentistry, Materia Medica and Therapeutics: Chairman, John C. Lupton, Cleveland, Ohio.

Orthodontia: Chairman, Henry F. Hoffman, Denver, Colo.

Plan your vacation to include a truly scientific meeting.

IRWIN A. EPSTEIN, *Chairman,*
Publicity Committee.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, St. Paul, Minn., August 6-10.

American Academy of Periodontology, St. Paul, Minn., August 2-4.

American Association for Advancement of Oral Diagnosis, St. Paul, Minn., August 6.

American Board of Orthodontia, St. Paul, Minn., August 6-10.

American Full Denture Society, St. Paul, Minn., August 4-5.

American Public Health Association, Pasadena, Calif., September 3.

American Society for the Promotion of Dentistry for Children, St. Paul, Minn., August 6.

American Society of Oral Surgeons and Exodontists, St. Paul, Minn., August 3-4.

Association of American Women Dentists, St. Paul, Minn., August 6.

Congress of Radiology, Zurich, Switzerland, July 24-31.

International Congress of Radiology, Zurich, Switzerland, July 24-31.

Mid-Southern Postgraduate Dental Clinic, Memphis, Tenn., October 22-24.

Montreal Dental Club Clinic, October 18-20.

New York Dental Centennial, New York City, December 3-7.

Northern Ohio Dental Association, Cleveland, June 4-6.

Pacific Coast Dental Conference, Long Beach, July 8-12.

Society for Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

Southern Society of Orthodontists, Hot Springs, Va., July 16-17.

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

American Dental Assistants Association, St. Paul, Minn., August 6-10.

American Dental Hygienists Association, St. Paul, Minn., August 6-10.

STATE SOCIETIES

June

Southern California, at Los Angeles (4-6)
Colorado, at Denver (18-20)
Georgia, at Atlanta (11-13)
Maine, at Augusta (22-23)
New Hampshire, at Lake Sunapee (27-28)
North Carolina, at Wilmington (18-20)
Oregon, at Portland (20-23)
Washington, at Tacoma (14-16)
Wyoming, at Cheyenne (22-23)

STATE BOARD OF DENTAL EXAMINERS

Alabama, at Birmingham, June 25. E. W. Patton, Secretary, 1807 Comer Bldg., Birmingham.

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

Arkansas, at Little Rock, June 18-21. Clarence W. Koch, Secretary, 817 Doneghey Bldg., Little Rock.

Arizona, at Flagstaff, July 16-21. R. A. McCall, Secretary, 719 Professional Bldg., Phoenix.

California, at Los Angeles, June 18. Kenneth I. Nesbitt, Secretary, 450 McAllister St., San Francisco.

Colorado, at Denver, June 5-9. Newton C. Gunter, Secretary, 610 Thatcher Bldg., Pueblo.

Connecticut, at Hartford, June 27-30. Almond J. Cutting, Recorder, Southington.

Delaware, at Wilmington, June 20-21. W. S. P. Combs, Secretary, Middletown.

Florida, at Jacksonville, June 25-30. R. P. Taylor, Secretary, 414 St. James Bldg., Jacksonville.

Indiana, at Indianapolis, June 12-17. J. M. Hale, Secretary, Mt. Vernon.

Kentucky, at Louisville, June 5-8. Robert L. Sprau, Secretary, 970 Baxter Ave., Louisville.

Maine, at Augusta, June 25-27. Alton H. Swett, Secretary, 192 State St., Portland.

Massachusetts, at Boston, June 12-15. W. Henry Grant, Secretary, Room 141, State House, Boston.

Minnesota, at Minneapolis, June 22-28. Hilen D. Aldrich, Secretary, 1104 Lowry Medical Arts Bldg., St. Paul.

Mississippi, at Jackson, June 19-21. T. Ford Leggett, Secretary, Laurel.

Missouri, at St. Louis, June 6-9. George E. Haigh, Secretary, Central Trust Bldg., Jefferson City.

Montana, at Helena, July 9-12. Leonard A. Jenkin, Secretary, Medical Arts Bldg., Great Falls.

New Jersey, at Trenton, June 25-30. John C. Forsyth, Secretary, 148 W. State St., Trenton.

Nebraska, at Lincoln and Omaha, June 11-16. Mrs. Clark Perkins, Director, Bureau of Examining Boards, Lincoln.

New Mexico, at Albuquerque, June 27-29. J. J. Clarke, Secretary, Artesia.

Ohio, at Columbus, June 25. Morton H. Jones, Secretary, 1553½ N. Fourth St., Columbus.

Oklahoma, at Oklahoma City, June 18-21. E. E. Sanger, Secretary, Yukon.

Pennsylvania, at Philadelphia and Pittsburgh, June 19-23. W. A. McCready, Secretary, 1115 Highland Bldg., Pittsburgh.

Rhode Island, at Providence, June 26-28. Albert L. Midgley, Secretary, Union Trust Bldg., Providence.

South Carolina, at Spartanburg, June 7-9. David Aiken, Secretary, Winnsboro Bank Bldg., Winnsboro.

South Dakota, at Sioux Falls, June 28-30. John J. Berry, Secretary, Deadwood.

Tennessee, at Memphis, June 11-16. B. C. Gallimore, Secretary, McKenzie.

Texas, at Houston, June 25-29. J. T. Edwards, Secretary, 1315 Medical Arts Bldg., Fort Worth.

Utah, at Salt Lake City, June 27-30. H. D. Brockbank, Secretary, 1003 Medical Arts Bldg., Salt Lake City.

Vermont, at Montpelier, June 25-27. H. B. Small, Secretary, Burlington.

Virginia, at Richmond, June 12. John M. Hughes, Secretary, Medical Arts Bldg., Richmond.

Wisconsin, at Milwaukee, June 18-22. S. F. Donovan, Secretary, Tomah.

ARIZONA STATE BOARD OF DENTAL EXAMINERS

The next meeting of the Arizona State Board of Dental Examiners will be held July 16-21, at Flagstaff. For further information, address

R. A. McCall, *Secretary,*
719 Professional Bldg.,
Phoenix.

COLORADO STATE BOARD OF DENTAL EXAMINERS

The next meeting of the Colorado State Board of Dental Examiners will be held June 5-9, at Denver.

Newton C. Gunter, *Secretary,*
610 Thatcher Bldg.,
Pueblo.

FLORIDA STATE BOARD OF DENTAL EXAMINERS

The Florida State Board of Dental Examiners will hold its annual examination

in Jacksonville, at the Seminole Hotel, June 25-30.

R. P. TAYLOR, *Secretary,*
414 St. James Bldg.,
Jacksonville.

OKLAHOMA STATE BOARD OF DENTAL EXAMINERS

The next meeting of the Board of Dental Examiners of the State of Oklahoma will be held June 18-21, Oklahoma City, in the Medical College Building.

E. E. SANGER, *Secretary,*
Yukon.

NEW YORK DENTAL CENTENNIAL

The one hundredth anniversary of the founding of the first dental society, "The Society of Surgeon Dentists of the City and State of New York," will be held December 3-7, at the Hotel Pennsylvania, New York City.

GEORGE C. DOUGLASS, *Chairman,*
Press and Publication Committee,
80 Hanson Place,
Brooklyn, N. Y.

NORTHERN OHIO DENTAL ASSOCIATION

The Northern Ohio Dental Association will hold its seventy-seventh session, at the Hotel Cleveland, Cleveland, June 4-6.

C. J. STARK, *Publicity Chairman,*
1034 B. F. Keith Bldg.,
Cleveland.

PACIFIC COAST DENTAL CONFERENCE

The fourth triennial Pacific Coast Dental Conference will be held at Long Beach, Calif., July 8-12.

E. LESLIE EAMES, *Secretary,*
618 Auditorium Bldg.,
Los Angeles, Calif.

COURSES OPEN TO PHILADELPHIA DENTAL COLLEGE AND TEMPLE UNIVERSITY DENTAL SCHOOL ALUMNI

Courses in all phases of dentistry will be available to graduates of the Philadelphia Dental College and Temple University Dental School, June 11-13, during the alumni meeting. There is no fee. Early registration is requested.

RAYMOND SCHWERING, *Publicity Chairman,*
Alumni Society,
Temple University Dental School,
Philadelphia, Pa.

SOUTHWESTERN SOCIETY OF ORTHODONTISTS

(Meeting Postponed)

The 1934 meeting of the Southwestern Society of Orthodontists has been postponed. The date of meeting will be announced later.

CURTIS W. WILLIAMS, *Secretary,*
Medical Arts Bldg.,
Shreveport, La.

AMERICAN SOCIETY FOR THE PROMOTION OF DENTISTRY FOR CHILDREN

The annual meeting of the American Society for the Promotion of Dentistry for Children will be held at the St. Paul Hotel, St. Paul, Minn., August 6. A luncheon will be given at noon at which all phases of dentistry for children will be discussed.

WALTER T. MCFALL, *Secretary,*
720 New St.,
Macon, Ga.

AMERICAN BOARD OF ORTHODONTIA

A special meeting of the American Board of Orthodontia for the consideration of new applications will be held in St. Paul, Minn., at the Hotel St. Paul during the meeting of the American Dental Association, August 6-10. For further information, address

OREN A. OLIVER, *Secretary,*
Medical Arts Bldg.,
Nashville, Tenn.

ASSOCIATION OF AMERICAN WOMEN DENTISTS

The thirteenth annual meeting of the Association of American Women Dentists will be held at the St. Paul Hotel, St. Paul, Minn., August 6.

GENEVA E. GROTH, *Chairman,*
Publicity Committee,
1301 Medical Arts Bldg.,
Philadelphia, Pa.

NATIONAL ALUMNI CHAPTER OF PSI OMEGA

The annual meeting of the National Alumni Chapter of Psi Omega will be held at the Lowry Hotel, St. Paul, Minn., August 7; annual banquet, August 6; headquarters and registration at the Lowry Hotel.

WALTER T. MCFALL, Grand Master,
720 New St.,
Macon, Ga.

AMERICAN DENTAL ASSISTANTS ASSOCIATION

The tenth annual meeting of the American Dental Assistants Association will be held in St. Paul, Minn., August 6-10, with headquarters at the St. Frances Hotel. For further information, address

RUTH M. CLARK, *General Secretary,*
Scofield Bldg.,
Minot, N. D.

PHILADELPHIA DISTRICT DENTAL HYGIENISTS ASSOCIATION

The Philadelphia District Dental Hygienists Association wishes to announce the opening of a registry for dental hygienists. Any dentist desirous of securing the services of a dental hygienist please address

HELEN TEMPLE,
128 N. 50th St.,
Philadelphia, Pa.

AMERICAN HOME ECONOMICS ASSOCIATION

The twenty-seventh annual meeting of the American Home Economics Association will be held in New York City, June 25-29.

HELEN W. ATWATER,
617 Mills Bldg.,
Washington, D. C.

SWINDLER

Warning is issued to dentists to protect themselves against the fraudulent dealings of a person claiming to be H. L. Day, salesman for men's clothing, for Cooper's, Nashville, Tenn. Letters addressed to this concern have been returned. The swindler is of medium height and weight, slightly bald and a ready talker.

CHICAGO DENTAL SOCIETY MAKES SUBSCRIPTION PRIVILEGE OF THE EDUCATIONAL REPRINT SERVICE AVAILABLE TO ALL MEMBERS OF THE AMERICAN DENTAL ASSOCIATION

A year ago, the Educational Committee of the Chicago Dental Society inaugurated its educational reprint service and offered the members an opportunity to subscribe. Briefly, the educational reprint service consists of the following: Each month, the Educational Committee publishes a short article on some phase of dentistry, free from technical terms, and of especial interest to lay readers, in the *Bulletin of the Chicago Dental Society*. After publication, reprints are made in large quantities and sent to subscribers, who, in turn, distribute them by mail or hand them personally to their patients. An explanatory letter to the patient accompanies the first one mailed. The articles are usually illustrated with suitable photographs or drawings. This reprint service is now available to all members of the A.D.A. The second series of twelve monthly articles started May 1 and subscriptions will be filled in the order in which they are received as long as the initial supply lasts. As thereafter, additional expense will be involved, please order at once, if you are interested.

Subscription Rates for the period May, 1934—April, 1935: 50 reprints monthly, $6; 100 reprints monthly, $8; additional quantities, $2 for each hundred reprints.

Application blanks can be obtained by addressing the Educational Committee of the Chicago Dental Society.

F. VAN MINDEN, *Chairman,*
185 N. Wabash Ave.,
Chicago, Ill.

AMERICAN DENTAL ASSOCIATION

St. Paul, Minn. Aug. 6-10, 1934.

HOTEL RESERVATION

In securing hotel reservations for the 1934 Session, consult the hotel rate-sheet and fill out the blank application below. Mail immediately to the hotel you wish to patronize. The hotel will then advise you of the reservation which has been made for you.

In case your first choice is not available, kindly indicate a second and a third choice. If none of these are available, the hotel manager will mail your application to the Chairman of Halls & Hotels Committee, who will make as favorable reservation for you as possible.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed on, please write or wire the hotel, releasing the room reserved for you in order that it may be available to others attending the meeting.

MAIL THIS APPLICATION DIRECT TO THE HOTEL

HOTEL RESERVATION

AMERICAN DENTAL ASSOCIATION, ST. PAUL, MINN., AUGUST 6-10, 1934.

.....Hotel.

St. Paul, Minn.

Please reserve sleeping accommodations as noted below:

.....Room (s) With bath for.....people. Rate desired per day $.....

.....Room (s) Without bath for.....people. Rate desired per day $.....

Second choice hotel..... Third choice hotel.....

ROOMS TO BE OCCUPIED BY:	ADDRESS IN FULL
Applicant.....	.....
.....	.....
.....	.....
.....	.....

Please confirm this reservation to applicant. I further agree to notify the hotel at once in the event I am unable to use this reservation.

IMPORTANT TO HOTEL MANAGER: In the event you cannot accept this reservation, please forward this application at once to Dr. E. J. Simon, Chairman Halls & Hotels Committee, 364 Lowry Medical Arts Bldg., St. Paul, Minn., who will attend to the assignment of this reservation.

HOTEL	With Bath One Person	With Bath Two Persons	Without Bath One Person	Without Bath Two Persons
ANGUS				
165 Western Ave.	$2.50-3.00	$3.50	$1.50	$2.50
	3.50	4.00		3.00
ASTORIA			2.00	
374 Wabasha St.	2.00-2.50	3.00-3.50	1.00	1.50
		4.00-4.50		
COMMODORE				
79 Western Ave.	2.50-3.00	4.00TB*-4.50TB		
	3.50-4.00	5.00TB-5.50TB		
	4.50-5.00	6.00TB		
EUCLID				
405 N. Washington St.	2.00-3.00	3.00-4.00-4.50	1.25	2.00
FREDERIC				
45 East 5th St.	2.00-2.50	3.00-3.50-4.00	1.25-1.50	2.00-2.50
HOTEL JEWELL				
17 East 5th St.	2.00-2.50	3.50-4.00	1.00-1.50	1.50-2.00-2.25
HOTEL ST. FRANCIS				
7th & Wabasha	2.50-3.00	4.00-4.50-5.00TB		
	3.50	5.50TB-6.00TB		
HOTEL ST. PAUL				
363 S. Peter St.	2.50S-3.00	4.00S-5.00		
	3.50	6.00TB-7.00TB		
	4.00 T&S	8.00TB-9.00TB		
	4.50 T&S	12.00 Suites		
	5.00 T&S	15.00 Suites		
LOWRY HOTEL				
339 Wabasha St.	2.50 S	3.50-4.00		
	3.00 S	4.50-5.00		
	3.50-4.00	6.00TB-6.50TB		
	4.50 T&S	7.00TB-7.50TB		
	5.00 T&S	15.00 Suites		
	12.00 Suites			
MARLBOROUGH				
148 Summit Ave.	2.00-2.50	3.00-3.50		
PALMER				
321½ St. Peter St.			1.00	1.50
RYAN HOTEL				
402 Robert St.	2.00-2.50	3.00-4.00TB		
	3.00-4.00	5.00TB-6.00TB		
ST PAUL ATHLETIC CLUB				
340 Cedar St. (Men only)	3.50			

*S, Shower; T&S, tub and shower; TB, twin beds.

RECENT BOOKS WORTH BORROWING* OR BUYING†

from the

LIBRARY BUREAU

of the

AMERICAN DENTAL ASSOCIATION

212 E. Superior St., Chicago, Ill.

Adams, C. W.	Your teeth and their care. St. Louis, Mosby, 1932. $1.25. Alfred David Lenz system of lost wax casting. New York, National Sculpture Soc., 1933. $1.50.
American Pharmaceutical Assn.	Pharmaceutical recipe book. Baltimore, Md., American Pharmaceutical Assn., 1929. $5.00.
Anderson, G. M.	Orthodontic laboratory manual. St. Louis, Mosby, 1930. $2.00.
Anthony, L. P.	Dental terminology. Chicago, American Dental Assn., 1930. (Free.)
Appleton, J. L. T., Jr.	Bacterial infection with special reference to dental practice. Philadelphia, Lea & Febiger, 1933. $7.00.
Appleton, J. L. T., Jr., & Bryant, C. K.	Laboratory guide in bacteriology. Philadelphia, Lea & Febiger, 1928. $2.75.
Bartels, H. A.	Outline of bacteriology. New York, W. A. Broder, 1929. $2.00.
Beck, Dorothy F.	Cost of equipping a dental office. Chicago, University of Chicago Press, 1932. $1.00.
Berger, Adolph	Principles and technique of oral surgery. Brooklyn, Dental Items of Interest Pub. Co., 1927. $7.00.
Berger, Adolph	Principles and technique of the removal of teeth. Brooklyn, Dental Items of Interest Pub. Co., 1929. $7.50.
Blayney, J. R.	Dental pharmacology and therapeutics. St. Louis, Mosby, 1934. $4.50.
Blunt, Katharine, & Cowan, Ruth	Ultraviolet light and vitamin D in nutrition. Chicago, University of Chicago Press, 1930. $2.50.
Bödecker, C. F.	Elementary histology for dental hygienists. New York, W. A. Broder, 1929. $2.00.
Bogert, L. J.	Nutrition and physical fitness. Philadelphia, Saunders, 1931. $3.00.
Bosworth, H. J.	Dental economics. Chicago, Bosworth Economic Institute, 1932. $10.00.
Bowler, Inez	Elementary manual of dental library practice. Ann Arbor, Univ. of Michigan Press, 1932.
Box, H. K.	Necrotic gingivitis. Toronto, University of Toronto Press, 1930. $1.00.
Box, H. K.	Treatment of the periodontal pocket. Toronto, University of Toronto Press, 1928. $1.00.
Bregstein, S. J.	Business conduct of an ethical practice. Brooklyn, Dental Items of Interest Pub Co., 1932. $4.00.
Broderick, F. W.	Dental medicine. St. Louis, Mosby, 1928. $6.00.
Broderick, R. A.	Dental bacteriology. Outlines of dental science. Vol. 2. Edinburgh, Livingstone, 1926. $2.50.
Brothers, E. D.	Dental jurisprudence. St. Louis, Mosby, 1928. $2.25.
Brown, A. J.	Dental metallurgy. Outlines of dental science. Vol. 11. New York, Wood, 1928. $2.50.
Brown, W. L.	Endocrines in general medicine. St. Louis, Mosby, 1927. $3.00.

*Books may be *borrowed* by members of the Association for a period of one week after date of receipt; and if not reserved for some one else, the period will be extended on request. A deposit of $2.00 for each volume to be sent at one time should accompany all requests for books. This will be refunded on return of books.

†If you wish to *purchase* books, indicate plainly which books you desire and enclose check with order.

Buckley, J. P.	Modern dental materia medica, pharmacology and therapeutics. Philadelphia, Blakiston, 1926. $6.00.
Bulleid, Arthur	Textbook of bacteriology for dental students. St. Louis, Mosby, 1927. $4.50.
Bunce, E. W.	Bunce-Kanouse full denture technic. Chicago, Coe Laboratories, Inc. 1929. $1.25.
Bunting, R. W.	A textbook of oral pathology for students and practitioners of dentistry. Philadelphia, Lea & Febiger, 1929. $7.00.
Burchard, H. H., & Inglis, O. E.	Textbook of dental pathology and therapeutics for students and practitioners. Philadelphia, Lea & Febiger, 1926. $7.50.
Burkhart, H. J.	Care of the mouth and teeth. (National Health Series.) New York, Funk & Wagnalls, 1928. $0.30.
Buxton, J. L. D.	Dental pathology. Outlines of dental science. Vol. 7. New York, Wood, 1927. $2.50.
Buxton, J. L. D.	Dental surgery. Outlines of dental science. Vol. 8. New York, Wood, 1927. $2.50.
Cahn, L. R.	Basic principles of general and oral pathology. Brooklyn, N. Y., Dental Items of Interest Pub. Co., 1929. $4.50.
Campbell, Menzies	Those teeth of yours. London, Heinemann, 1931. $1.50.
Casto, T. D.	Questions and answers on pedodontology, with glossary. Philadelphia, Author, 1932. $2.50.
Cattell, Psyche	Dentition as a measure of maturity. Cambridge, Harvard University Press, 1928. $1.00.
Churchill, H. R.	Human odontography and histology. Philadelphia, Lea & Febiger, 1932. $4.50
Clark, C. A.	Dental radiography. Outlines of dental science. Vol. 5. New York, Wood, 1926. $2.50.
Cogswell, W. W.	Dental oral surgery. Pittsburgh, Penna., Dental Digest, Inc., 1932. $10.00.
Colyer, J. F., & Sprawson, Evelyn	Dental surgery and pathology. New York, Longmans, 1931. $12.50.
Colyer, Stanley	Chronic infection of the jaws: a short radiological and clinical study. New York, Macmillan, 1926. $3.50.
Committee on Costs of Medical Care	Medical care for the American people. Chicago, Univ. of Chicago Press, 1932. $1.50.
Dall, William	Ground porcelain inlays. London, Henry Kimpton, 1933. $5.25.
Daukes, S. H.	Medical museum: Modern developments, organization and technical methods based on a new system of visual teaching. London, Wellcome Foundation, Ltd., n.d. (No purchase orders accepted.)
Davis, M. M.	Paying your sickness bills. Chicago, University of Chicago Press, 1931. $2.50.
Dental Board of the United Kingdom	Four lectures on "general anaesthesia." London, Dental Board of the United Kingdom, 1926. $2.00.
Dental Board of the United Kingdom	Three lectures on "dental alloys." Delivered under the auspices of the Dental Board of the United Kingdom. London, Dental Board of the United Kingdom, 1927. $2.00.
Diamond, M.	Dental anatomy. A graphic presentation of tooth forms with an original technique for their reproduction. New York, Macmillan, 1929. $3.50.
Dorrance, G. M.	Operative story of cleft palate. Philadelphia, Saunders, 1933. $6.50.
Doxtater, L. W.	Procedures in modern crown and bridge-work. Brooklyn, N. Y., Dental Items of Interest Pub. Co., 1931. $8.00.
Endleman, Julio	Special dental pathology; a treatise for students and practitioners. St. Louis, Mosby, 1927. $7.00.
Ennis, L. M.	Dental roentgenology. Philadelphia, Lea & Febiger, 1931. $6.50.
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Fine, Samuel	Principles and practice of dental assistant. Worcester, Mass., Hamilton Pub. Co., 1931. $2.50.
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Hackh, I. W. D.	Chemical reactions and their equations. Philadelphia, Blakiston, 1928. $2.00.
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Harder, O. E.	Modern dental metallography. Minneapolis, Minn., Burgess-Roseberry Co., 1930. $3.75.
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Head, Joseph	Everyday mouth hygiene. Philadelphia, Saunders, 1925. $1.00.
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Headridge, Davis, & Gibson, S. K.	Dental anatomy, human and comparative. Outlines of dental science. Vol. 6. New York, Wood, 1928. $2.50.
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Hodgen, J. D.	Practical dental metallurgy. St. Louis, Mosby, 1932. $3.75.
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McBride, W. C.	Juvenile dentistry. Philadelphia, Lea & Febiger, 1932. $2.75.
McCaw, Emma J.	Dental assistant. St. Louis, Mosby, 1926. $1.50.
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Prinz, Herman	Dental formulary. Philadelphia, Lea & Febiger, 1930. $3.50.
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Prothero, J. H	Prosthetic dentistry. Chicago, Medico-Dental Pub. Co., 1928. $10.00.
Pusey, W. A.	Doctor of the 1870's and 1880's. Baltimore, C. C. Thomas, 1932. $3.00.
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Report of Committee on Growth and Development	Growth and development of the child. Part III. Nutrition. (A publication of White House Conference on Child Health and Protection.) New York, Century, 1932. $4.00.
Report of Committee on Public Health Organization	Public health organization. (A publication of White House Conference on Child Health and Protection.) New York, Century, 1932. $3.00.
Reports of Subcommittees on Nutrition and Health Centers	Nutrition service in the field. Child health centers: a survey. (A publication of White House Conference on Child Health and Protection.) New York, Century, 1932. $2.00.
Roberts, Lydia J.	Nutrition work with children. Chicago, University of Chicago Press, 1927. $3.50.
Rose, Mary S.	Foundations of nutrition. New York, Macmillan, 1927. $2.75.
Rukeyser, M. S.	Doctor and his investments. Philadelphia, Blakiston, 1931. $2.50.
Schroff, Joseph	Fundamentals of pathology. New York, W. A. Broder, 1929. $2.50.
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Silverman, S. L.	Principles and practice of oral surgery. Philadelphia, Blakiston, 1926. $6.00.
Simon, P. W.	Fundamental principles of systematic diagnosis of dental anomalies. Boston, Stratford, 1926. $5.00.
Simon, W., & Base, Daniel	Manual of chemistry. Philadelphia, Lea & Febiger, 1927. $5.00.
Simons, A. M., & Sinai, Nathan	Way of health insurance. Chicago, University of Chicago Press, 1932. $2.00.
Simpson, C. O.	Advanced radiodontic interpretation. St. Louis, University Press, 1931. $35.00. (Because of the unusual price and its lack of durability a rental fee of $1.00 will be charged for this book for each two weeks it is in circulation.)
Simpson, C. O.	Technic of oral radiography. St. Louis, Mosby, 1928. $5.00.
Simpson, C. O.	Toothsome topics. St. Louis, University Press, 1931. $2.50.
Skinner, E. W.	Dental materials and technology. Cleveland, Ohio, Author, 1933.
Smith, D. T.	Oral spirochetes and related organisms in fusospirochetal disease. Baltimore, Williams & Wilkins, 1932. $4.50.
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Stieglitz, Julius	Chemistry in medicine. New York, Chemical Foundation, 1928. $2.00.
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Stillson, W. C.	Dental anatomy: classroom and laboratory quiz compend with supplementary notes. Philadelphia, Saunders, 1929. $2.25.
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Strang, R. H. W.	Textbook of orthodontia. Philadelphia, Lea & Febiger, 1933. $10.00.
Sure, Barnett	Vitamins in health and disease. Baltimore, Williams & Wilkins Co., 1933. $2.00.

Suter, A. B. W.	Dentistry—a profession and a business. Rochester, N. Y., Ritter Dental Mfg. Co., 1930. $7.50.
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Turner, C. R., & Anthony, L. P.	American textbook of prosthetic dentistry. Philadelphia, Lea & Febiger, 1932. $10.00.
Tyree, C.	Dental health in the prevention of disease. London, Kentucky, Author, 1927. $2.75.
Ullmann, E. V.	Diet in sinus infections and colds. New York, Macmillan, 1933. $2.00.
Urling, L. H.	Your teeth; their care and preservation. Philadelphia, Dorrance, 1932. $1.50.
Wallace, J. S.	Physiology of oral hygiene and recent research. London, Bailliere, Tindall & Cox, 1929. $4.00.
Wallace, J. S.	Teeth and health. London, Faber & Gwyer, 1926. $1.40.
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Weinberger, B. W.	Orthodontics: an historical review of its origin and evolution. 2 vols. St. Louis, Mosby, 1926. $25.00.
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Winter, Leo	Textbook of exodontia. St. Louis, Mosby, 1931. $10.00.
Wolfenden, H. H.	Real meaning of social insurance. Toronto, Canada, Macmillan, 1932. $2.00.
Woodbury, C. E.	Making and filling of cavities in the proximal surface of the front teeth with gold foil. Omaha, Neb., Author, 1929. $5.00.
Zemsky, J. L.	Oral diseases: practical treatise offering diagnostic and therapeutic aid to the practitioner of medicine and dentistry. Brooklyn, N. Y., Physicians and Surgeons Book Co., 1930. $8.00.
Zemsky, J. L.	Outline of oral surgery. Brooklyn, N. Y., Physicians and Surgeons Book Co., 1930. $4.50.
Zoethout, W. D.	Textbook of physiology. St. Louis. Mosby, 1928. $4.50.

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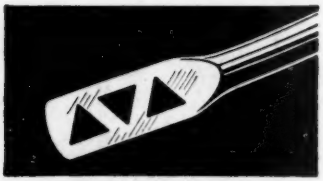

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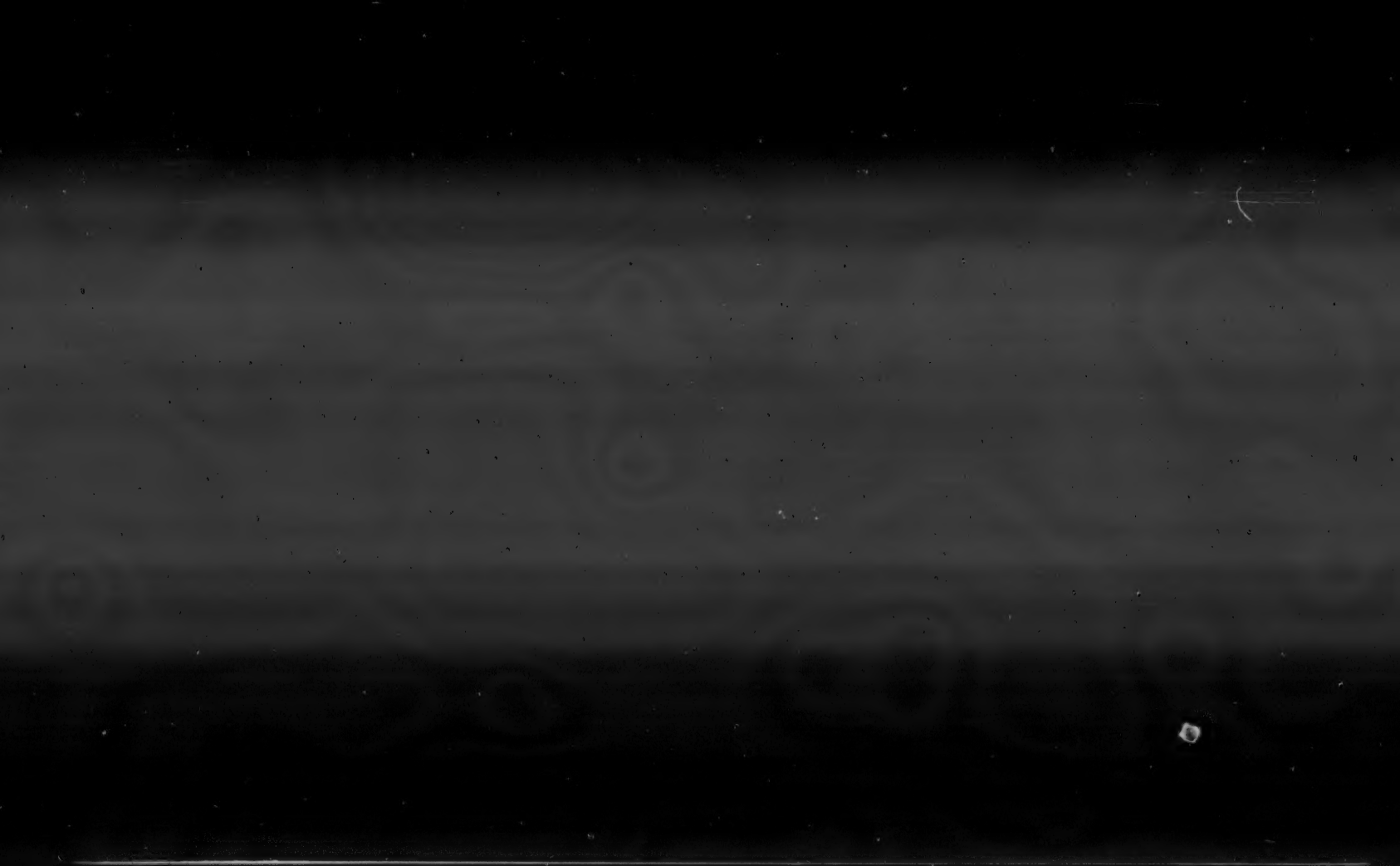
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